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ABSTRACT

Data from the Schools and Staffing Survey, and from New York and Texas, were analyzed in 1999 to identify prevailing trends in the vocational education (VE) teacher labor market. The data, all secondary sources, were analyzed by using a set of indicators for detecting shortage or surplus conditions, and a set of guidelines for developing behavioral models to explain labor supply choices on the part of individuals, and labor demand choices on the part of educational agencies. Among the main findings of the analysis were the following: (1) both the absolute size of the VE teaching force, and its size relative to the total teaching force, appear to have declined since the early 1980s; (2) although VE teachers tended to be evenly split between men and women, a great deal of occupational segregation existed across subfields; (3) compared with nonvocational teachers, VE teachers tended to be significantly older and have lower levels of educational attainment; and (5) existing data fail to capture the information needed to determine whether shortages exist in teacher labor markets. (Contains 169 references and 71 tables/figures. Appended are a description of the primary data sources and 32 supplementary tables/graphs from the National New York and Texas Teacher Databases.) (MN)

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Preface

Predictions of teacher shortages are widespread. Rising enrollments point to a buoyant demand for teachers over the next decade, particularly at the secondary level. At the same time, monitored vocational education has been in a perceived decline since the early 1980s. In this report, we bring together available data from various sources in a supply and demand framework as a first step to better understanding the current state of the labor market for secondary vocational education teachers. This is a first step because it is clear that existing national data are insufficient to adequately characterize and predict shortages or surpluses in the teacher labor market. The report highlights the need for the collection of new data.

This report is based on research conducted between January 1999 and October 1999. It uses secondary sources; no new data could be collected within the timeframe and budget of the project. The report is written to be accessible to lay readers.

The report was funded by the Office of Vocational and Adult Education (OVAE) through the National Center for Research in Vocational Education (NCRVE), University of California, Berkeley.

Executive Summary

This report outlines the prevailing trends in the vocational education teacher labor market using data from the Schools and Staffing Survey at the national level and from the states of New York and Texas. It provides a structure for analyzing the vocational education teacher labor market and develops both a set of indicators for detecting shortage or surplus conditions and a set of guidelines for developing behavioral models to explain labor supply choices on the part of individuals and labor demand choices on the part of educational agencies. The report highlights the need for data collection on reported vacancies, district curriculum offerings, teacher quality, and the movements of teachers in and out of the teacher labor pool.

Summary of Findings

The findings reported in this study can be summarized as follows:

- The size of the vocational teaching force and its size relative to the total teaching force appears to have declined since the early 1980s. We find evidence of this decline using data at the national level between 1988 and 1994, data from New York between 1980 and 1998, and data from Texas between 1988 and 1996.

- Vocational education teachers tended to be evenly split between men and women, but a great deal of occupational segregation existed across subfields. Racial and ethnic differences between vocational and nonvocational education teachers were not apparent, although some differences were apparent across subfields.

- Vocational education teachers were significantly older on average than nonvocational education teachers, and their average age increased over time. Vocational education teachers in vocational schools were older than those in comprehensive high schools. Agriculture teachers tended to be the youngest. Health, trade and industry, and technical teachers tended to be the oldest, with the latter two groups showing a faster rate of age growth over time. The significance of a higher and growing average age is difficult to determine. It could be that fewer openings were being offered due to a lowered demand, that fewer openings were being filled due to a decrease in supply, or that openings were progressively being filled by older people.

- Vocational education teachers had lower levels of educational attainment than nonvocational education teachers, due primarily to the fact that

training programs for many vocational fields, such as health and trade and industry, are completed at the associate degree level. Vocational education teachers without bachelor's degrees, however, tended to be concentrated in vocational high schools. Vocational education teachers in comprehensive high schools tended to have similar degree profiles to nonvocational education teachers.

- Vocational education teachers had slightly more teaching experience than nonvocational education teachers in each year of the sample, about one and a half years more in 1994. This may be due to smaller proportions of new teachers in this population or to the greater teaching longevity of vocational education teachers. Since the average age differential was about two years, the experience gap could be attributed largely to age. The experience differential grew over time, as the average experience level grew more steeply for vocational education teachers than for nonvocational education teachers.

- Vocational education teachers were more likely to have had industry experience than other teachers as one would expect given the work-oriented nature of their teaching assignments and the fact that work experience is often permitted as a substitute for education in the vocational teaching certification process. The fields with the most teachers with outside experience were health, trade and industry, and technical.

- Real salaries of vocational education teachers were higher in 1991 than in 1988 and 1994. The same pattern occurred for nonvocational education teachers. The salaries of vocational education teachers in vocational schools were significantly higher in 1991 and 1994 than those of the same types of teachers in comprehensive schools. These teachers were older and tended to have more industry experience, but they had less public school teaching experience and lower educational credentials. In general, average salaries tended to be higher for older groups of teachers.

- Educational barriers to entry contained in the certification process for vocational education teachers were lowered between 1988 and 1998, but we are unable to assess whether the loosening of educational requirements occurred in response to perceived shortages or in response to changes in philosophy as to the types of qualifications that signal vocational teaching adequacy.

- Public secondary enrollments declined between 1980 and 1990 and then began to rise at a fairly constant rate. They are projected to rise through the year 2007, and the greatest increases will occur within the Hispanic population.

- In accordance with enrollment trends, pupil-teacher ratios declined between 1988 and 1991 and then rose by 1994. They did not rise to their 1988 levels, however, despite the fact that enrollments were higher in 1994 than in 1988. A slight lag in the response to enrollments seems to have been operating as the teaching labor market adjusted. Although pupil-teacher ratios for vocational education teachers were significantly lower than they were for nonvocational education teachers, they rose and fell in the same proportion.

- In the period between 1982 and 1994, there was a notable decline in vocational course taking, due, by many accounts, to a slackening in the demand for this type of instruction and an overall trend towards a more academic high school curriculum. Trade and industry was the field experiencing the greatest decline. Hispanics, who had traditionally been the group with the highest enrollment in vocational education, shifted their course-taking patterns dramatically to become less involved in vocational education than most other groups by the end of the period.

- The proportion of new entrants—that is, teachers without prior teaching experience—declined for both the vocational and nonvocational groups between 1988 and 1991. The proportion of new entrants to vocational teaching was lower than that to nonvocational teaching in both years, however. For the former group, the decline continued through 1994; for the latter group, it leveled off. Vocational schools showed the greatest decline in this proportion, suggesting that these schools were either less desirable or less available to new entrants during this time period. With respect to vocational subfields, only health, business, and technology showed an increase in the percentage of new entrants, with the largest increase occurring for health.

- Attrition rates of both vocational and nonvocational education teachers were found to be higher at early and late ages. We therefore replicated the expected U-shaped attrition-by-age pattern found in prior research. In 1988, vocational education teachers appeared more likely to quit at an early age than nonvocational education teachers, but they tended to retire at older ages. By 1994, this pattern had nearly reversed. A plot of attrition by experience level also produced a U-shaped pattern. The U-shaped attrition-by-experience pattern for vocational education teachers and the distinction between vocational and nonvocational education teachers became more pronounced over time.

- Fewer schools reported vacancies in vocational fields than in academic fields, but this is not surprising due to the greater proportion of academic teachers in almost all types of high schools except vocational schools.

Among schools reporting vacancies, industrial arts and trade and industry were the two vocational fields that were the most difficult to fill. Schools in rural areas appeared to have had the greatest difficulty filling vocational vacancies.

Key Points and Conclusions

There was a decline in the number of vocational education teachers in the U.S. between 1988 and 1994, and state-level data for New York and Texas suggest that the decline was evident in the early 1980s as well. In addition, the proportion of vocational education teachers to the total teaching force declined during this time period. There was a decline in the average number of vocational courses taken by public secondary school students between 1982 and 1994. The average age of vocational education teachers increased between 1988 and 1994, and the proportion of new entrants to vocational teaching declined during this period.

These empirical facts could be the result of either a decrease in the demand for vocational education, a decrease in the supply of vocational education teachers, or a combination of the two. Newer teachers, for example, may be unavailable for hire due to a shortage, or newer teachers may not be sought after as the result of a surplus. It is difficult to distinguish which of the two causes has been primarily responsible for the observed trends. Attempts to do so with existing data provide mixed results. While educational barriers to entry into the profession appear to have loosened between 1988 and 1998, suggesting that policymakers may have acted to reduce a shortage of vocational education teachers, the actual educational levels of vocational education teachers increased during this time period, suggesting that these barriers to entry were not constraining.

Existing data do not capture the information needed to determine whether or not shortages exist in teacher labor markets. Data on vacancies are not collected in a manner that would enable researchers to make conclusive assertions. Without evidence pertaining to the movements of vocational education teachers in and out of teacher labor markets and their alternative sources of employment, it is not possible to understand why they are present in or absent from the teaching force.

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CHAPTER I

Introduction

This report uses multiple data sources to assess current demand and supply conditions in the labor market for secondary vocational education teachers in the United States. A statistical profile of secondary vocational education teachers is presented in which vocational education teachers in different disciplines are compared to each other and to academic teachers. On the demand side, enrollment trends and course-taking patterns are reviewed. On the supply side, the available supply of new and re-entering teachers is assessed from a review of secondary sources, and new evidence on teacher retirements and attrition patterns are derived from state and national data sources. Our goal is to identify and gather evidence on observable indicators of the supply of and the demand for secondary vocational education teachers at a level of detail sufficient to reveal the major underlying factors driving trends. Wherever possible, we identify potential future trends, and the implications of any imbalance between demand and supply is analyzed with an emphasis on the range of policy options that might help alleviate any shortage. This report lays the groundwork for future database development on the vocational education teacher labor market.

Background

According to many observers, the contemporary workplace is evolving, and global competition is pushing businesses to continually reinvent themselves, their processes, and their products. Consequently, there is a growing need for technically trained, qualified young people with lifelong learning skills. In this context, the National Board for Professional Teaching Standards (NBPTS) (1997) writes:

> Vocational educators play a crucial role in preparing young people to function successfully in the adult world they will soon enter. They build students' knowledge of leading-edge technologies, their capacity to solve problems they have yet to encounter and their understanding of the world of work. Because these are times of significant change—in education, in the world economic market place, in many of our cities, towns, and families—the goals and purposes of vocational education teachers have more saliency than ever. (p. 9)

Changes taking place in schools and the teaching profession clearly reflect a recognition of the central role that vocational educators are expected to play in preparing the nation's future workforce. For example, much recent school reform is aimed at improving the adequacy of vocational education offerings, at integrating vocational and academic programs, and at replacing "conventional teacher-centered didactic instruction with more activity-based, project-oriented methods" (NBPTS, 1997, p. 9). In recognition of the need for accomplished vocational educators who can put these reforms into practice, NBPTS has established eight fields in which vocational educators can seek National Board Certification: Agriculture and Environmental Sciences; Arts and Communications; Business, Marketing, Information Management, and Entrepreneurship; Family and Consumer Sciences; Health Services; Human Services; Manufacturing and Engineering Technology; and Technology Education. The standards for board certification range from knowledge of subject matter to creation of a learning environment, from helping students transition to work and adult roles to establishing collaborative partnerships with the community, business, and industry. There is a recognition of the need for vocational education teachers to be able to teach what Murnane and Levy (1996) call the "New Basic Skills" needed for students to prosper in a changing economy.

Alongside economic developments, enrollment trends and course-taking patterns suggest an uncertain future for vocational education. Following *A Nation at Risk* (National Commission on Excellence in Education, 1983) and the subsequent increase in academic course requirements in high schools, the percentage of high school seniors reporting enrollment in vocational high school programs has fallen dramatically, from 22.4% in 1972 and 24.4% in 1980 to just 12.3% in 1992 (U.S. Department of Education, 1995, Figure 2.1, p. 17). This change has been reflected in a significant decline in the number of secondary vocational education teachers in public schools: for example, from 137,025 in 1990-1991 to 120,067 in 1993-1994, a 12.4% decline (U.S. Department of Education, 1993b, Table 4.1; U.S. Department of Education, 1996, Table 4.1).

However, demographic trends suggest that the nation's public schools will face increasing enrollment over the next decade, peaking at 48.4 million in 2006 before leveling off (U.S. Department of Education, 1998b, Table 1). This represents an increase of 6% over 1996 levels; total enrollment is already at its highest level in American history. Projections by the National Center for Education Statistics (NCES) suggest that the K-8 population will rise through 2002 and then decline through 2008 (remaining 2% over 1996 levels), while the population in grades 9-12 will rise through 2007, reaching 15% over 1996 levels. It is important to note, however, that the projected increases are far from uniform geographically. Some states may actually see declines (notably in the Midwest), while others will see more dramatic increases (e.g., California). Moreover, unlike the experience of the 1970s,

no substantial decline in enrollment is expected after the baby boom echo graduates. Much of the increase will be in the number of minority students.[1] The National Commission on Teaching and America's Future (1996) suggested that these trends will lead to an enormous increase in the demand for teachers—upwards of two million. Where these teachers will come from and where and what they will teach is a crucial issue.

Key Questions

These economic, policy, and demographic developments suggest a need for more information about vocational education teachers:

- Who is currently teaching vocational education, and what are their characteristics?
- What are the demand-side prospects for vocational education teachers—that is, how many, and what type of, teachers are likely to be needed over the coming decade or so?
- What are the supply-side prospects for vocational education teachers—that is, how many, and what type of, teacher trainees and potential teachers are available to staff vocational classrooms over the next decade?
- Does the analysis of supply and demand in the labor market imply a shortage or surplus of qualified vocational education teachers in the future, and what policies might help correct any imbalance?

Unfortunately, there appear to be few answers. Little attention has been specifically paid to the vocational education teacher labor market. In fact, as Lynch (1991) found, research on vocational education teachers appears to be "nonexistent" (p. 2). This study proposes to fill in some of the gap by providing a detailed profile of vocational education teachers in the current teaching force and by mapping and understanding, to the extent possible with available data, the demand and supply of vocational educators in the future. Due to limitations with respect to both time and the potential for data gathering, however, the primary contributions of this report will be to provide a structure for analyzing the vocational education teacher labor market, to assemble an informative set of facts pertaining to this market based on existing data sources, to describe a set of scenarios motivating these stylized facts, and to point the way to effective strategies for future data collection and analysis.

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[1] The number of Hispanic children aged 5-17 years is expected to grow by a third in the next decade, and more than double by 2025, while the number of African-American children aged 5-17 years is expected to grow by a quarter by 2025 (U.S. Bureau of the Census, 1997).

The Characteristics of Vocational Education Teachers

In order to begin to understand the vocational education teacher labor market (both as a whole and by subfield) it is important to know who is currently in the profession and what their concerns are. This includes questions like the following:

- What is the demographic composition (age, sex, race/ethnicity) of the nation's vocational education teachers, how is it changing, and how does it compare to that of academic teachers?
- What education, training, and prior work experience do vocational education teachers have?
- Where do vocational education teachers teach and what are they teaching?
- How much are vocational education teachers paid?

In each case, it is important to provide a point of comparison—that is, to contrast vocational education teachers to those in other fields.

Demand

Conceptually, the demand for vocational education teachers depends on a number of key factors, each of which requires consideration. The number of vocational education teachers will be determined by the total student population, course-taking patterns, and educational polices and resources that have an impact on the demand for vocational education. These components suggest a number of important questions worthy of investigation:

- What factors influence the demand for vocational education teachers?
- What do we know about future prospects for enrollment that have implications for the demand for vocational education teachers, and how do they vary by region and in terms of student demographics?
- How are student course-taking patterns changing—that is, do students want to undertake vocational education programs?
- What are recent (and future) policy developments likely to entail for schools' willingness and ability to hire new vocational education teachers?

Supply

Understanding the supply side of the vocational education teacher labor market—the number and quality of individuals who will be available to fill available positions—is a critical but complex component of the analyses. The supply is made up of two main groups: (1) those experienced in teaching vocational education courses and (2) those newly entering teaching who may be either just completing college or transferring from industry or other

professions. Since entry to teaching is restricted by state licensing requirements, the role these play in influencing an individual's career decisions is important to understand (e.g., see Ballou & Podgursky, 1997; Lynch & Griggs, 1989):

- What factors influence the supply of vocational education teachers?
- What factors explain vocational education teachers' attrition, mobility, and retirement patterns, and do vocational education teachers behave in substantively different ways from other types of teachers? What implications do these patterns and differences produce for public policy?
- How many new vocational education teachers are completing approved licensing requirements, and of these, how many are drawn directly from industry or other professions?
- How do licensing requirements affect the available supply of teachers?

Implications

Pulling together the answers to the preceding questions yields an indication of the overall health of the vocational education teacher labor market—that is, is there a coming shortage or surplus of vocational education teachers? Policy levers available to affect supply and demand—for example, salary incentives to affect attrition or retirement, changing certification requirements, and so on—need to be systematically analyzed. To shed light on these issues, we ask the following:

- What are the indicators of surplus or shortage?
- Has the vocational education teacher market exhibited signs of a surplus or shortage in the past decade?
- Does the evidence point to possible future shortages or surpluses?

The four broad questions guiding the project encompass a large number of important issues, and given the short duration of this study and the paucity of available data, it is not possible to provide definitive answers. Rather, the goal of this study is to provide an overview of what is currently known, supplement past research with new analyses using data from state sources, and highlight the important missing pieces that future research needs to address. The study should therefore be seen as the first step in building a quantitative database and deeper understanding of the vocational education teacher labor market. Attention will be confined to *high school vocational education teachers at public schools.*[2]

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[2] These limitations do not greatly affect coverage in this study. In 1993-1994, there were 124,886 vocational education teachers. Of these, 99% were in secondary schools, and of this number, 97.1% taught in public schools. Hence, there were 120,067 public secondary vocational education teachers. (U.S. Department of Education, 1996b, Table 4.1, p. 71).

It is also important to note at the outset that we refer throughout the report to "vocational education teachers" in a way that to some extent belies the difficulty of attaching that label to some fields. Traditionally, we can think of vocational education teachers as those in the following fields: agriculture, business, health, home economics, industrial arts, and trade and industry. Increasingly, as the boundaries between academic and occupational education have broken down, the distinction has become less clear because teachers classified as academic now often teach in new vocational programs such as career academies; therefore, the actual set of instructors teaching vocational education encompasses more teachers than those classified in existing datasets as vocational education teachers. This makes an accurate analysis of "vocational education teachers" even more problematic.

The remainder of this report is organized as follows: Chapter II presents a conceptual framework identifying the factors determining supply and demand in the vocational education teacher labor market; Chapter III describes the methodology used in this report; Chapter IV presents our findings; and Chapter V discusses these findings and their possible implications for policy.

CHAPTER II

Conceptual Framework

This chapter outlines a conceptual framework that identifies the factors determining the supply of and demand for vocational education teachers. The foundation for the labor market framework laid out here is discussed in more detail in standard labor economics textbooks (e.g., see Ehrenberg & Smith, 1994). Broad discussions of the teacher labor market may be found in Murnane et al. (1991) and Barro (1992). This chapter describes the conditions under which a shortage or surplus of vocational education teachers would result. The conceptual framework outlined in this chapter forms the basis for the development of the methodology discussed in Chapter III, the analysis reported in Chapter IV, and the suggestions for future research and data collection offered in Chapter V.

The Labor Market for Public Secondary Vocational Education Teachers

The interaction of supply and demand occurs within the confines of a labor market. A labor market is composed of all of the buyers and sellers of labor services. In the case of teachers, the buyers are generally school districts and the sellers are those individuals who are qualified and willing to teach. The price of the labor service is primarily the wage, and this is generally determined by the interaction of the forces of supply and demand. In the case of teaching, collective bargaining and institutional features such as certification place limits on the operation of the market.

In general, the size and boundary of a labor market is determined by the mobility of its participants. For example, if teachers are generally unwilling to relocate to other geographic areas to pursue better job opportunities, then teacher labor markets will be fairly localized. If, on the other hand, teachers are highly mobile and willing to move from town to town, then their labor market might more appropriately be considered statewide. If teachers are mobile enough to move from state to state and their credentials are compatible across states, then their labor market could be considered national. In this latter case, the wages offered to teachers by districts in New York could affect those offered to teachers by districts in California.[3] Any state that wishes to increase its own supply of teachers could do so by

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[3] For the purpose of simplicity, we will generally describe teacher compensation in terms of wages. A more sophisticated and realistic description of compensation, however, would include benefits and working conditions. It can be assumed throughout, with no loss of generality, that the term "wages" carries with it the implications of "total compensation."

raising its wages above those of other states and thus draw teachers away from other states.

Similarly, the transferability of teaching qualifications to other types of jobs will play a role in determining the scope of the labor market. If vocational education teachers possess skills that are easily transferable to industries outside of education, then wages offered by outside industries can also influence those offered by school districts, as the range of buyers of vocational education teacher services expands beyond the educational system.

For the purposes of the following discussion, local school districts will be considered the primary buyers of vocational education teacher services, bearing in mind, however, that outside districts, cities, states, and industries are affecting the determination of wages by offering more or less attractive alternative job opportunities to these types of teachers. Furthermore, these opportunities may very well be different for teachers in different kinds of vocational subfields.

Demand

The economic definition of the total demand for vocational education teachers in a given labor market is *the number of vocational education teachers that districts are willing to hire under prevailing market conditions.*[4] Prevailing market conditions refer primarily to the "price" or market wage of a vocational education teacher. In reality, as previously noted, the price of any type of worker includes more than simply the wage. It also includes the price of benefits and any other costs associated with the type of worker in question. The quantity of labor demanded generally decreases as the price of labor increases; therefore, an inverse relationship exists between wages and demand.

Within the context of this definition of demand, it is possible to specify the factors that underlie the "willingness" of districts to hire vocational education teachers. The demand for vocational education teachers is a "derived" demand. That is, it is derived from the demand for vocational education. The demand for vocational education in a particular school district can be described as resulting from the district's preferences regarding the following two dimensions of instruction:

1. Desired curriculum
2. Desired mode of delivery

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[4]The "number" of vocational education teachers referred to is more precisely defined as the number of full-time equivalent (FTE) teachers, rather than the number of individual teachers. Two part-time teachers working at 50% time each, for example, make up one FTE.

The curriculum refers to the number of vocational courses offered by the district and their type such as business, trade and industry, and agriculture. The mode of delivery encompasses features such as the quality of the teaching staff, the number of students per teacher, and the instructional setting.

The delivery system of vocational instruction refers both to the ability levels of vocational education teachers and to pedagogical features such as the classroom setting and pupil-teacher ratios. The determination of teacher quality is a difficult task, yet the notion that certain teachers are more capable than others is plausible. If teachers are heterogeneous with respect to quality—that is, differentiated in their levels of skill—then it is likely that those who are more skilled will command a higher wage. This is particularly the case if districts are able to distinguish those who are highly skilled from those who are not. Thus, depending upon the district's ability to identify heterogeneity, a trade-off between quantity and quality will be evident to the district, adding a layer of complexity to the process of determining the optimal level of employment of particular types of teachers.

Among instructional features, the choice of a pupil-teacher ratio is critical to the determination of demand. Although, in some instances, there may be policy-related constraints on the ability of a district to exceed a certain class size,[5] districts often have the resource flexibility to expand or shrink classes as needed or desired. There may be pedagogical reasons for teaching certain subjects in small classes and others in large classes, as, for example, the need for one-on-one instruction in "hands on" courses in auto maintenance and repair. There may also be short-term circumstances that cause districts to deviate from desired class size levels. For example, if teachers leave and their positions cannot be filled immediately, class size may increase. If enrollment falls and existing staff cannot be laid off, then class size may decrease.

A school district, in determining the number of vocational education teachers to hire, will assess the needs of its student population for vocational instruction and decide upon the best way to deliver this instruction, but this determination will occur after a number of factors have been weighed. The following factors underlie the demand for vocational education:

- Total enrollment levels
- State mandates and policies affecting vocational curriculum and instruction

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[5] Class sizes or pupil-teacher ratios may be limited in various ways. For example, some districts have collectively bargained contracts that specify class sizes. Over the past several years, many states have introduced class size reduction policies that specify class sizes by law in certain grades (see Brewer, Krop, Gill, & Reichardt, 1999; Parrish et al., 1998). These generally have been imposed at the elementary grade level.

- Student course-taking preferences regarding vocational education
- Preferences expressed by the outside community
- The needs of the local or regional economy
- Funding available for vocational education courses
- The wages paid to vocational education teachers

Taking these factors into account, districts undergo a complex decisionmaking process in order to determine the numbers of vocational education teachers they wish to employ.

The first set of factors, the number and type of students enrolled in school, is simply a function of the age and demographic distribution of the area's population.[6]

Districts will also generally take the wage levels needed to obtain a particular type of teacher to be a given for a given level of teacher quality. As mentioned in the previous section, the price of a specific type of teacher is determined by market forces that are larger than the district itself. In addition to the competitive market forces exerted by the presence of alternative employment opportunities, there may also be institutional forces, such as unions or labor laws, that influence the wage. Given these prices, districts will attempt to reach optimal levels of the employment and quality of teachers.[7]

Given enrollments and the price of labor, a district will choose its desired type and quantity of vocational instruction (i.e., its vocational curriculum). The desired curriculum is determined in response to the needs and behavior of a number of constituencies.

Students can influence course-offerings when elective courses are involved. If, for example, students do not sign up in large numbers for existing elective courses, these courses may be dropped. Or, if a number of students wish to take a course in health or some other vocational education

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[6] While school-related factors, such as the quality of instruction or the size of the student population, may influence a particular area's demographics through the mechanism of residential mobility (Tiebout, 1956), the opposite situation is more usually the case—that is, that demographics exert a powerful influence upon the characteristics and practices of schools.

[7] According to standard economic models, districts engage in a "utility maximization" process in making hiring decisions. For-profit firms act to maximize profits and nonprofit firms act to minimize costs, after taking wages and prices as exogenous. Districts are under no pressure to maximize profits in the traditional sense and under only limited pressure to minimize costs and can therefore be said to act in a manner that enables them to maximize their "utility" (i.e., level of satisfaction). In other words, districts are entities that minimize costs in a manner consistent with their educational mission and other factors influencing their level of satisfaction. For a discussion of the behavior of school districts see, for example, Chambers (1978).

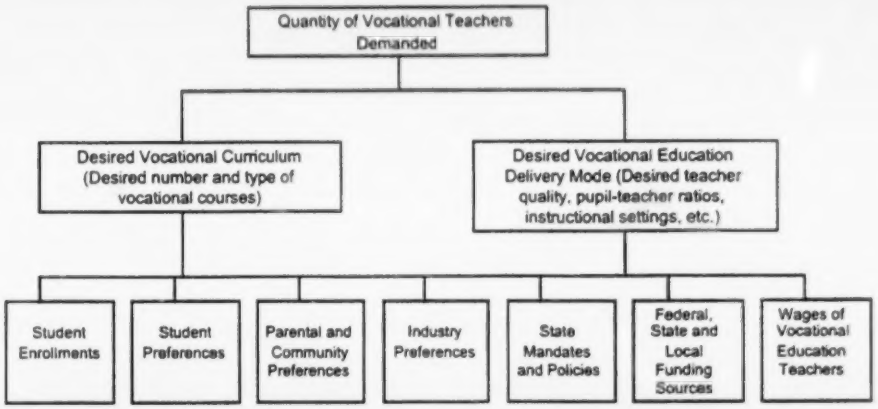
field, then school administrators may respond by offering such a course. Similarly, the parent community can exert an influence over curriculum. Local industries may also influence vocational education course offerings by providing facilities and funds to schools. The local economy or the presence of large employers in the district's geographical area may influence the nature of the curriculum and induce administrators to provide trained personnel. Districts in Iowa, for example, will be more likely to provide courses in agriculture than those in New York City.

In addition, district administrators will often have priorities and requirements to fulfill that are independent of student and community perceptions of needs. For example, there may be state or federal mandates affecting vocational education curriculum. An increase in the academic requirements for graduation could result in a decrease in vocational education course offerings. State efforts to increase academic course taking on the part of secondary school students can, in turn, generate a decline in vocational education course offerings. On the other hand, states may require students to take a certain number of vocational education electives in order to graduate. In addition to mandates designed to influence curriculum directly, standards for performance or accountability may be based upon academic achievement or the college entrance rate of graduates and thus have a negative impact on vocational education course offerings, although state-based performance standards may encompass work-related programs. Funding considerations may also weigh heavily in a district's decision to expand or shrink its vocational education offerings. Certain sources of local, state, or federal funding may be tied to enrollments in vocational education courses or particular types of these courses. These funding issues may affect either a district's preferences or the constraint it faces in deciding how much vocational education to provide and, hence, how many vocational education teachers to hire. Certain districts may not have as much local wealth to tap into as a funding source for programs. Certain districts may not have access to industries willing to provide equipment or work space for apprentice type instruction.

In theory, if enough information were known about the preferences of districts regarding curriculum and instructional practice, specific constraints, and exogenous wages and prices, the demand for vocational education teachers could be predicted. Models of district behavior could be constructed to describe the process by which districts decide upon the number of vocational education teachers they wish to employ.

All of the factors mentioned above—curriculum requirements, performance and accountability standards, budgetary considerations, student course-taking patterns, parental voice, and so on—will influence demand. Figure 2.1 presents a schematic diagram of the components of demand.

Figure 2.1. The Major Components of the Demand for Vocational Education Teachers


Quantity of Vocational Teachers Demanded
Desired Vocational Curriculum (Desired number and type of vocational courses)
Desired Vocational Education Delivery Mode (Desired teacher quality, pupil-teacher ratios, instructional settings, etc.)
Student Enrollments
Student Preferences
Parental and Community Preferences
Industry Preferences
State Mandates and Policies
Federal, State and Local Funding Sources
Wages of Vocational Education Teachers

It is important at this point, however, to emphasize the conceptual distinction between desired choices and actual hiring decisions. The actual number of vocational education teachers that districts employ does *not* necessarily reflect the desired number, nor does the curriculum offered necessarily reflect the desired curriculum. Because the number of vocational education teachers available to work in a given district may be insufficient to meet demand, the quantity of teachers demanded may, on occasion, be greater than the number of teachers employed. In addition, if institutional factors, such as unions, inhibit the ability of districts to let go of unneeded teachers, then demand, on occasion, can fall short of the number of teachers employed.

In addition, there is little theoretical justification for considering pupil-teacher ratios for schools or districts to be representative of the desired ratios. In fact, pupil-teacher ratios may be a commonly used "stop-gap" valve to eliminate a mismatch between supply and demand. If that is the case, then actual pupil-teacher ratios may be the *result* of supply or demand considerations rather than a factor driving demand—that is, they are endogenous. What is observed in terms of employment, curriculum, and pupil-teacher ratios is the product of the interaction of supply and demand. This distinction between underlying demand and what is observed is one reason why it is so difficult to predict shortages or surpluses or to characterize a labor market as in equilibrium or disequilibrium using observed data.

Supply

The economic definition of the supply of vocational education teachers in a given labor market is *the number of eligible individuals willing to teach*

vocational education given prevailing market conditions. Eligible individuals would be those who are deemed qualified to teach vocational education courses. Market conditions, in this case, refer to expected salaries, benefits, and working conditions. The quantity of labor supplied generally increases as the wage increases[8]; therefore, a positive relationship exists between supply and the wage.

The total supply of vocational education teachers in a particular labor market is a function of the size of the pool of eligible individuals and the attractiveness of vocational education teaching relative to other possible choices of work or nonmarket activity. The eligible pool of vocational education teachers is composed of the following two groups:

1. Experienced vocational education teachers
2. Individuals without experience who are qualified to teach vocational education

In order to predict supply levels at some point in the future, it is necessary to obtain forecasts of the expected number of experienced teachers and the expected number of qualified individuals who will be willing to work as vocational education teachers.

The group of experienced teachers willing to work as vocational education teachers in the future will consist, in large part, of the stock of current vocational education teachers. This group may be augmented by teachers who wish to transfer into the labor market from the outside, teachers from other types of teaching who wish to transfer into vocational education, and teachers who wish to return to teaching from nonteaching activities. Also, if the total number of teachers at a given point in time is calculated on the basis of full-time equivalent (FTE) teachers, rather than on the basis of individuals, then teachers who wish to go from part-time to full-time status can also increase the size of the group. The size of the group will be diminished, on the other hand, by those who choose voluntarily either to leave the district, to reduce their hours of work, or to leave teaching, in general.

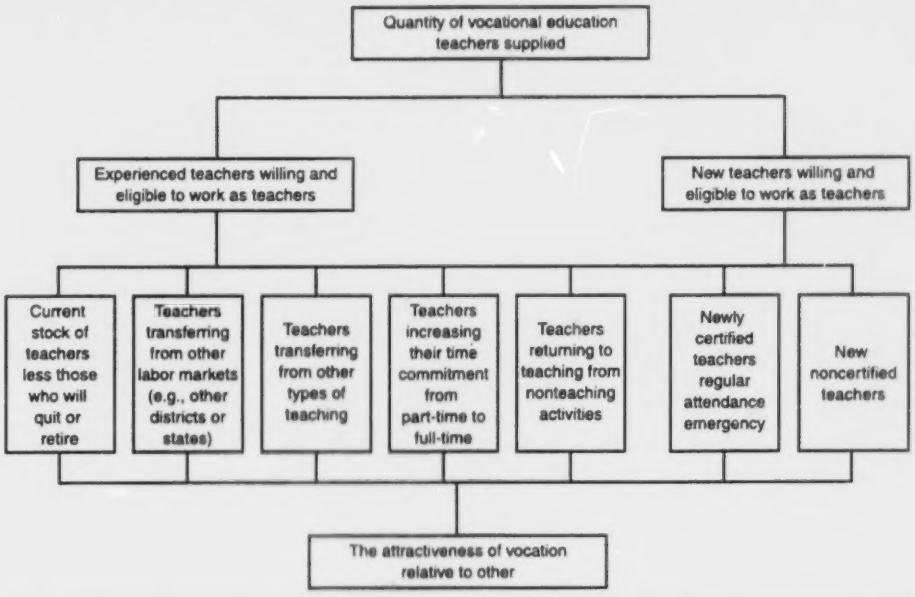
The group of potential teachers new to teaching and willing to work in the future will consist primarily of newly credentialed teachers. It may also include noncredentialed individuals, those with less than full regular certification if alternative certification methods are permitted in the labor market in question. This group may be composed of individuals from outside industries who wish to enter the teaching profession as well as those graduating from a nonteaching oriented program of study.

Figure 2.2 presents a schematic diagram of the elements of supply. The factors that underlie the "willingness" of individuals in each of these groups

[8] Again, we use the term "wage" to represent total compensation.

to teach vocational education—that is, the relative attractiveness of vocational education teaching—are the salaries, benefits, and working conditions of vocational education teachers relative to those of other types of work or activity that they are qualified to perform.

Figure 2.2. The Components of the Supply of Vocational Education Teachers


Quantity of vocational education teachers supplied
Experienced teachers willing and eligible to work as teachers
New teachers willing and eligible to work as teachers
Current stock of teachers less those who will quit or retire
Teachers transferring from other labor markets (e.g., other districts or states)
Teachers transferring from other types of teaching
Teachers increasing their time commitment from part-time to full-time
Teachers returning to teaching from nonteaching activities
Newly certified teachers regular attendance emergency
New noncertified teachers
The attractiveness of vocation relative to other

A particular individual's choice of a career as a vocational education teacher will depend on his or her personal "cost-benefit" analysis. Market characteristics, such as overall employment opportunities, which may depend upon geographical location or which may fluctuate in accordance with the business cycle, will most likely play a role in determining relative wages, benefits, and working conditions. Individual characteristics such as age, sex, marital status, parental status, experience, and ability may also play a role because they affect preferences and the range of alternative opportunities. Individuals undergo a complex decisionmaking process to choose the type and number of hours of work perceived by them to be optimal.[9] If enough information were known about the preferences of individuals and the constraints imposed upon them, then their labor supply choices could, in theory, be predicted.

[9] As in the case of district demand choices, an individual's choice of the type and amount of labor supply is described in economic terms as a utility maximization process. Taking potential wages as exogenous, an individual makes the trade-off between different types of labor and leisure by weighing the alternatives in light of his or her own preferences and constraints.

As in the case of demand, the actual numbers of vocational education teachers employed do not necessarily reflect the true level of supply. It may represent a lower bound, if the supply of qualified persons willing to teach exceeds the number of existing teaching positions.

Shortage or Surplus

In theory, a shortage or surplus of vocational education teachers can be predicted by comparing predicted demand to predicted supply at a given point in time. If demand is projected to exceed supply at the expected wage rate, then there will be a shortage. If supply is projected to exceed demand at expected wage rates, then a surplus will result. As we have seen, it is difficult to determine the true level of either supply or demand using observed data. A discussion of the interaction of supply and demand, nevertheless, will help us to identify a set of measures that indicate shortage or surplus scenarios.

According to our economic definitions of supply and demand, a shortage will exist if the quantity of labor demanded exceeds the quantity of labor supplied *at the prevailing wage rate*. The classical economic model assumes that wages are free to fluctuate according to demand- or supply-related pressures. It is assumed that labor markets can reach equilibrium—that is, the state in which the quantity demanded equals the quantity supplied—through movements in the wage. Figure 2.3 represents a schematic diagram of how the quantity of labor demanded and supply fluctuates in response to changes in the wage. The higher the wage, the lower the quantity demanded and the higher the quantity supplied.

Movements along the supply and demand curves are produced in response to changes in the prevailing wage. The actual slope and position of the curve depends on a number of outside factors. The entire demand curve, for example, could shift downward if schools and districts were suddenly forced to decrease their vocational curriculum due to state policies mandating that high school students increase their academic courseloads. The entire supply curve, for example, could shift downward if outside opportunities for those qualified to teach vocational education were suddenly to improve dramatically. These types of externally induced—or exogenous—shifts in the curves represent important changes in the labor market that can upset or change an equilibrium state. When these changes occur, the prevailing wage is temporarily no longer the one in which the quantity of labor demanded equals the quantity of labor supplied. Figure 2.4 depicts a movement towards a different quantity supplied and demanded engendered by an exogenous downward shift in the demand curve from D_0 to D_1. This figure assumes that wages are allowed to adjust from W to W_1.

Figure 2.3. Supply and Demand in a Labor Market Under an Equilibrium Scenario

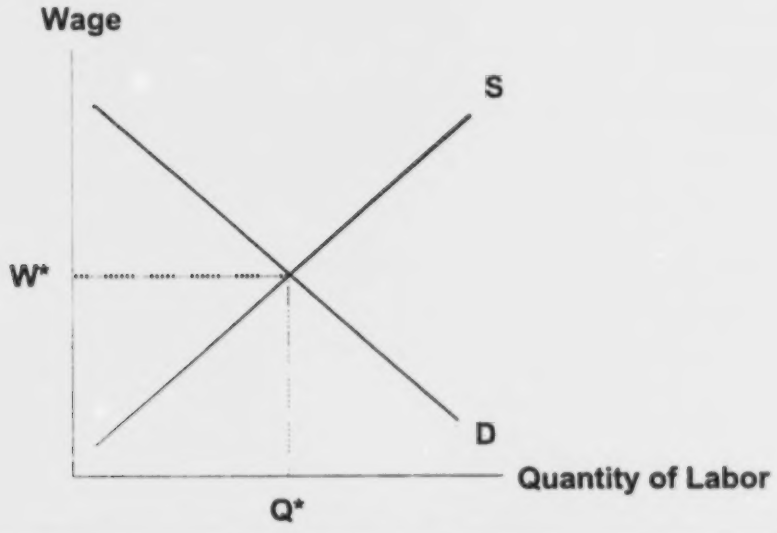
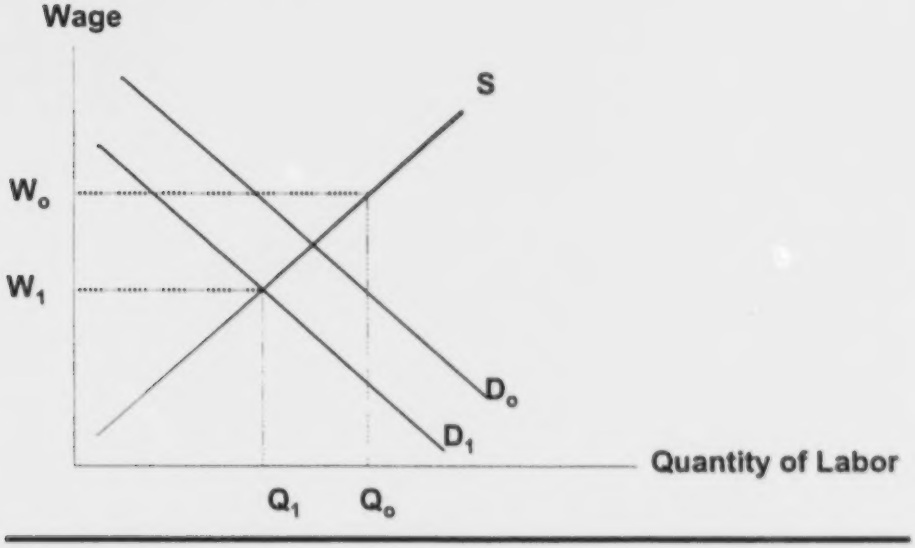
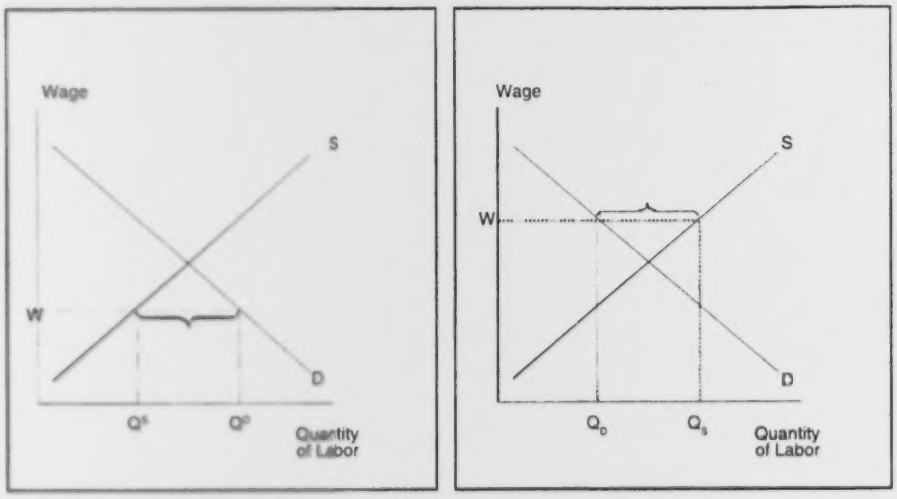


Figure 2.4. A Downward Shift in the Demand for Labor



Shortages occur when the wage is below market clearing levels. Surpluses occur when the wage is above market clearing levels. Figure 2.5 is a graphical depiction of a shortage and a surplus scenario. In labor markets in which wages freely adjust to shifts in supply or demand, shortages or surpluses are likely to be very short-lived, as the market quickly reaches a new equilibrium quantity.

Figure 2.5. Disequilibrium Scenarios in a Labor Market



Shortage Surplus

In many labor markets, however—teaching being one of them—wages do not always rise and fall freely in response to the pressures of supply and demand. Institutional factors related to unions or to public employment may introduce rigidities into the wage determination process. Unions and other labor institutions are generally more resistant to downward pressure on the wage caused by an excess of supply over demand than to the upward pressure caused by an excess of demand over supply. In addition, due to pressures within the teaching profession to equalize salaries across teaching subfields, wages in particular subfields may not be allowed to deviate freely from others, despite the fact that the labor market for this subfield may be distinctly different in character from the others. The typical school district salary schedule applies to all teachers regardless of field shortages or specific surpluses; therefore, chronic shortages or surpluses can exist in various teaching subfields—vocational education, in particular, being one of them. Within vocational education, furthermore, certain subfields may be affected more than others.

Shortages come into being if the wage rate is below market clearing levels and may persist if the wage does not adjust. In this case, it is difficult for individuals with the potential to teach vocational education to be induced to enter the supply of vocational education teachers. There may be aspects of the "total compensation" of teachers, however, that do not remain rigid. Districts may attempt to offer increased alternative inducements, such as better career ladders, better benefits, better working conditions, signing bonuses, and so on. These may fluctuate somewhat freely and mitigate the rigidity of the monetary wage.

Surpluses come into being if the wage rate is above market clearing levels and may also persist if wages are rigid. In the case in which wages remain above market clearing levels, however, surpluses may decrease if potential teachers perceive their real returns to teaching to be diminished by the fact that jobs are difficult to find. A high perceived unemployment rate for vocational education teachers will signal lowered returns to those supplying this type of labor, but the resultant contraction in supply will most likely occur more slowly than in the case in which the wage had been free to adjust downward.

In addition to wage fluctuations and alternative methods leading to the realignment of the quantity of labor supplied and that demanded, several temporary coping mechanisms might be utilized by market participants. Given the measure of wage rigidity characteristic of the teaching profession, a shortage scenario might manifest itself in a number of different ways. As mentioned previously, districts are free to increase their pupil-teacher ratios if teachers for classes are not found. If districts are able to distinguish high-quality teachers from those of lesser quality, then the quality of newly hired teachers might decrease, as districts can no longer afford to be selective. Barriers to entry, such as certification requirements, might be lowered. The expected consequences of a shortage would therefore be the following:

- Increases in real salaries
- Increases in other forms of compensation (e.g., bonuses, career ladders)
- Increases in pupil-teacher ratios
- Decreases in quality
- Decreases in barriers to entry

The expected manifestations of a surplus would be opposite to those outlined for a shortage. In the absence of direct information on supply and demand, inferences can be made about the existence of shortages or surpluses by examining changes in these variables. Given the rigidities of teacher labor markets, however, policies that are unrelated or impervious to supply and demand forces can sometimes play a role in causing changes in these indicators. Again, this illustrates the difficulty of making definitive statements about the existence of shortages or surpluses in a labor market.

Summary

This chapter has outlined a conceptual framework pertaining to the elements of the supply of and demand for a particular type of worker in a given labor market. From the abstract economic definitions of supply and demand, we have developed working definitions of the supply of and demand for vocational education teachers and have identified the components that must be studied in order to predict future trends. As we have seen, each of the factors underlying supply and demand exerts a force that is the result of a further set of underlying factors.

The demand for vocational education teachers is derived from the demand for a particular vocational education curriculum delivered in a particular manner. The components shaping the demand for vocational courses and instructional techniques are student enrollments, student preferences, community and industry preferences, state policies, funding sources, and the prices associated with the employment of vocational education teachers. Records of past trends in the numbers of vocational education teachers employed provide useful indicators of changes in demand, but may underestimate or overestimate true demand.

The components of supply are the quantities of experienced teachers who are willing and eligible to work and the quantities of individuals with no prior teaching experience who are willing and eligible to work. The category of experienced teachers can be divided into the following subcategories: current teachers less those who will leave their jobs, teachers transferring from other labor markets, teachers transferring from other types of teaching, those increasing their time commitment from part-time to full-time, and teachers returning to teaching after a hiatus. The category of individuals without teaching experience is composed of newly credentialed teachers and noncredentialed individuals qualified to teach in vocational education fields. The decision of individuals to move in and out of the vocational education teaching force are motivated by comparisons of the satisfactions offered by teaching to those offered by alternative forms of employment for which they are qualified. Records of past trends in the employment of these groups provide useful indicators of changes in supply, but may underestimate the true level of supply.

In addition, in this discussion of supply and demand, several policy levers affecting the vocational education teacher labor market have been identified. Curriculum requirements, pupil-teacher ratios, the nature of performance indicators used in accountability systems, and funding formulas are levers used at the local and state levels that exert a great deal of influence on the demand for vocational teaching. One step further removed but still subject to the influence of policy would be efforts to affect ties to the local economy and to affect the wealth distribution across schools and districts using means other than funding formulas.

Based on the framework outlined above, the next chapter develops a model for an empirical analysis capable of informing predictions regarding future levels of the supply of and demand for vocational education teachers.

CHAPTER III

Creating an Empirical Model: Methodological Approaches

Forecasts of trends in teacher labor markets are desirable tools for educational policymakers. Forecasts, in general, consist of projections based on past trends. The sophistication with which forecasting models are constructed can vary considerably. Models that are sometimes referred to as *mechanical* models (e.g., Barro, 1992) are based on average expected growth rates and extrapolations of the trends. For example, in predicting the number of newly certified vocational education teachers two years from now, one might examine existing and past numbers of newly certified vocational education teachers, calculate an average rate of growth or decline and apply this rate to the next two successive years to yield a prediction. Alternatively, one might plot current and past numbers over time and extrapolate linearly to find the point estimate that would apply at two years beyond the end of the sample. If plots reveal changing growth rates or if cyclical fluctuations are evident, then quadratic or cubic rather than linear extrapolation techniques can be used to improve the accuracy of the prediction.

Behavioral models provide an alternative approach to forecasting. Behavioral models rely on an understanding of the particular factors influencing the choices of individuals or organizations that result in the trend of interest. For example, in the case of newly certified vocational education teachers, rather than extrapolate from previous trends, one could collect data on a sample of individuals who might choose to enroll in a vocational education teaching program and attempt to identify the factors that form the basis for this career choice. Such factors might be the wages earned by vocational education teachers; the wages of other jobs open to those in the sample; the cost of the teacher education program; and a number of individual-level characteristics such as age, sex, socioeconomic status, or college major. The selection of pertinent factors is guided by an underlying model of career choice. Multivariate statistical models are frequently used to determine the relative importance of each factor in predicting the choice outcome. Forecasts based on behavioral models will track trends in the factors and calculate predicted future numbers of, say, newly certified vocational education teachers by inserting predicted factor values into the formula produced by the model.

Both types of models have limitations. Simple mechanistic models may overlook the importance of changes in key underlying factors and thus

produce misleading results. Behavioral models are generally difficult to implement on a large scale due to their data requirements.

Barro (1992) warns that, when using mechanical models to predict teacher supply and demand, a certain level of disaggregation is necessary in order to reduce the potential for aggregation bias. In demand models, for example, trend projections of enrollments by subject or by student characteristics are more useful than overall enrollment predictions. In supply models, trend projections of attrition based on subcategorizations by age, race, and sex are more accurate than projections based on the extrapolation of aggregate figures.

As the level of disaggregation increases, the distinction between mechanical and behavioral models begins to blur. Each sublevel requires new and more detailed data. Adding new dimensions is equivalent to conditioning on new factors. In reality, mechanical and behavioral models could be considered two endpoints on a continuum.

It is also important not to assume constant rates in fitting trends. For example, prior research indicates that the demand for a particular type of teacher does not respond proportionately to increases or decreases in enrollment for the corresponding type of subject (Connecticut Board of Education, 1988, cited in Barro, 1992). It is good practice to experiment with extrapolation using a variety of approaches and possibly not in a linear manner.

As we saw in the last chapter, both the supply of and the demand for vocational education teachers contain several subcomponents requiring separate attention. A large-scale investigation of the type outlined in this report would ideally require a multifaceted approach.

Given the short-term nature of this project and the limitations of available data, however, we utilize a methodology that could be considered a precursor to both mechanical and behavioral modeling. Guided by the economic theory outlined in the preceding chapter, we gather information on trends that we consider to be of relevance to the various aspects of supply and demand. We then bring together as much information as possible using graphical aides in order to highlight the interrelationships among variables. We then develop a set of plausible explanations for the revealed patterns. We do not develop a projection model or produce numerical forecasts. These would necessitate the collection of data at the microlevel. Initially, we had proposed the collection of new data on vocational education teacher supply and demand from school districts, schools of education, and other sources. Unfortunately, the time limitations of the study prevented such new data collection. In our concluding chapter, however, we do identify areas that we feel should be carefully monitored in an ongoing assessment of shortage or surplus conditions, and we point the direction for further research in these areas.

The data used in this study come from multiple sources, including the following:

- The Schools and Staffing Survey (SASS), waves 1987/1988, 1990/1991, and 1993/1994 and their subsequent one-year follow-ups, conducted by the National Center for Education Statistics. A new SASS will unfortunately not be available until 2000/2001. All SASS tabulations reported on this document are weighted to be nationally representative with weights provided in the dataset.
- The New York Personnel Master File data collected from all New York teachers for the school years ending 1980 through 1998. A detailed description of each of these datasets is provided in Appendix 1.
- The *Texas Snapshot Series* collected from all Texas teachers between the years 1988 and 1996 by the Texas Education Agency.

The national dataset presents a useful picture of the characteristics of all teachers. It has the advantage of containing very large samples of teachers; however, it also has limitations. Notably, it is somewhat dated in the current changing environment and is not longitudinal. Although SASS resurveys a subsample of teachers one year following each wave, the survey is not longitudinal across successive waves. Various state databases collected for administrative purposes can be used to track individual teachers over time, however, including movements between school districts and out of teaching. Two of the most comprehensive and accessible databases are those of New York and Texas. These are also large states and provide a useful contrast given their geographic, economic, and demographic differences. The analysis of New York data was conducted at Suny-Albany by James Wyckoff, Hamilton Lankford, and Frank Papa.

Secondary data sources include various publications by the U.S. Department of Education, the U.S. Bureau of the Census, and other entities engaging in the production of education- and population-related statistics. These sources are noted when used.

In addition, our findings are informed by a series of telephone interviews conducted by the study team with the following individuals:

- Representatives of state and federal agencies involved in vocational education teacher education
- Representatives of vocational administration teachers and student organizations
- Representatives of teachers unions
- Academic experts on both vocational education teachers and the teacher labor market more generally

Anonymous excerpts from these interviews are occasionally included in the discussion below.

The Number and Characteristics of Vocational Education Teachers

We first present trends in the numbers of vocational education teachers employed, with an accompanying disaggregation by vocational subfield. The relationship of vocational education to the rest of the teaching labor force is examined. Data are presented for the national teaching workforce using the SASS and for the teaching labor force in New York and Texas.

We next examine the characteristics of vocational education teachers by providing a detailed set of informative descriptive statistics. Tables and plots are presented showing time trends in the percent of the vocational education teacher workforce that is female, the percent that is non-white, the average age, the average level of teaching experience and industry experience, the percent in particular degree status categories, the percent in particular certification status categories, and average real salaries.

Throughout our descriptive analysis of the characteristics of vocational education teachers, we offer a number of instructive comparisons. We compare vocational education teachers to nonvocational education teachers, and, wherever possible, we conduct hypothesis tests of differences in means. The comparison of vocational to nonvocational education teachers enables us to highlight the important distinguishing features of the vocational education teacher labor market.

We also compare vocational education teachers who teach in comprehensive high schools to those who teach in vocational schools—that is, schools designed specifically to support the vocational education curriculum.

In addition, since the vocational education curriculum is composed of several widely different subspecialties, we provide the same set of descriptive statistics for teachers in each subspecialty. Often strong variation occurs across subfields.

We also compare findings pertaining to the national teaching force, obtained via the SASS, to findings obtained using data from New York and Texas in order to get a sense of how much the vocational education scenario in these states varies from the aggregate picture.

This descriptive analysis provides us with a statistical profile of vocational education teachers in the U.S. and important contextual information upon which to base our interpretations of the indicators of supply and demand.

Indicators of Supply

According to the conceptual framework outlined in the preceding chapter, the components of supply are the numbers of experienced and new teachers who are willing and eligible to work as vocational education teachers. Since those who work may only be a subset of those willing to work, the simple tracking of employment patterns can be a misleading indicator of supply. At any given point in time, there may be a "reserve pool" of teachers who are willing to work but not currently employed. If demand matches or exceeds supply, the reserve pool may be "empty."

The determination of the size of the reserve pool is problematic due to a lack of data on the "willingness to teach" of members of the population who are not currently teaching. One approach to obtaining an estimate of the reserve pool would be to obtain information regarding applications for teaching positions. Unfortunately, data on the latter are sparse. In addition, the concept is itself problematic. Applicants for positions are often submitted in response to announcements or advertisements for open positions, so the presence of applicants in one labor market and none in another labor market may be purely the result of differences in demand rather than supply (Barro, 1992).

The Supply of New Teachers

An alternative approach would be to gather information on subgroups within the reserve pool. It is possible, for example, to obtain approximate predictions of the numbers of teachers who will obtain new teaching certificates. These can be obtained both by extrapolating from past trends in the acquisition of certificates and from behavioral models that identify the factors influencing an individual to choose to obtain a vocational education certificate. Unfortunately, data on the production of newly certificated teachers are not collected at the national level, and we were unable to confirm prior findings.

Prior research indicates that the production of newly trained vocational education teachers has been in decline. Lynch (1998a) reports that the number of vocational education teacher education programs has dwindled over time. Researchers have reported declines in enrollment in vocational education teacher programs in business (Luft & Noll, 1993; Schmidt, 1985). Ruhland (1993) reported a decline in institutions granting degrees in the teaching of marketing. The number of family and consumer sciences teachers graduating from universities dropped from 852 in 1987 to 315 in 1996 (Zehr, 1998). Factors to be incorporated into a behavioral model of career choice would be those related to the characteristics of individuals who are in the pool of potential vocational education teachers and to the characteristics of vocational education teaching and other alternatives that are perceived by these individuals. The former set of characteristics might consist of factors such as age, sex, socioeconomic status, marital status,

and so on. The latter set of characteristics would be perceived as the salaries, benefits, and the perceived working conditions of vocational education and other relevant alternative occupational choices. Because the choice of interest, that of vocational education teaching, is highly specific and the range of individuals who could potentially become a vocational education teacher is great,[10] a large longitudinal dataset would be required to support an effective behavioral model of career choice in this case. This type of analysis has therefore remained outside the scope of the current study. We do, however, include tables showing the proportion of new entrants—teachers without prior teacher experience—to vocational and nonvocational teaching over time, nationally, and for the state of Texas.

As mentioned in our conceptual discussion of shortages, a potential indicator of a persistent shortage would be the lowering of barriers to entry over time. As part of the process of entering the labor market, a teacher must be certified, and certification can act as a barrier to entry.[11] Certification poses less of a barrier to vocational education teachers, however, than to other types of teachers. Educational standards for vocational education teachers are often less rigorous, and work experience is often considered a substitute for standard educational credentials. This is especially true for teachers of trade and industry. As a result, vocational education teachers are on average less educated than their fellow secondary teachers (U.S. Department of Education, 1993, p. 4a1).

Certification is a requirement for nearly all public teaching positions across the United States. The SASS data tell us that 98% of vocational education teachers were certified to teach in 1988 and 99% were certified in 1994. The corresponding percentages for nonvocational education teachers were 96% and 97%. The requirements for certification, however, can vary enormously from state to state, some of them being very easy to fulfill. Also, some reciprocity in the acceptance of outside certification exists across states. Certification, itself, therefore, is not necessarily a strong barrier to entry.

States can raise or lower barriers to entry in one of two ways: (1) they can allow more people to teach who are either not certified or provisionally certified or (2) they can raise or lower the requirements to obtain a permanent teaching certificate. In order to explore the different aspects of certification, we gathered both information regarding the substitution of provisional for permanent certification and information regarding changes in the requirements for permanent certification over time for the nation as a whole.

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[10] Whereas most potential teachers are required to have a bachelor's degree before entering certification programs, vocational education teachers frequently do not possess even this level of education.

[11] For a discussion of teacher certification see Feistritzer (1998), Goldhaber and Brewer (unpublished draft), and Ballou and Podgursky (1997).

A permanent certificate is generally good for life and, in most cases, requires a higher level of education for both vocational and general secondary teachers. Permanent certificates often require bachelor's degrees, but for vocational education teachers, work experience is often considered an acceptable substitute for the degree. Provisional or temporary certificates are usually good for fewer than five years and are often issued to individuals with less than full credentials in their educational training, work experience, or other requirements in order to enable individuals to gain the necessary requirements to become permanently certified.[12] We examined changes in the degree to which provisional and noncertification were allowed to substitute permanent certification in the state of New York.

We also present a quantitative summary of certification requirements for vocational education teachers at two points in time to ascertain whether the barrier has been raised or lowered. The *Manual on the Preparation and Certification of Educational Personnel* produced by the National Association of State Directors of Teacher Education and Certification (NASDTEC) is published yearly and, thus, changes in certification over time can be observed. Using the 1988 and 1998 editions, we examine the changes in certification requirements over time for vocational education teachers.[13]

The Supply of Experienced Teachers

Since the largest component of supply is composed of the group of teachers with experience, it is useful to trace particular historical patterns in the stocks of vocational education teachers that shed light on the issues of exit from the profession. We track the experience levels of vocational education teachers over time.

The transferability of vocational skills to industrial settings would be expected to increase the likelihood of attrition for vocational versus nonvocational education teachers. Retirement is also likely to be an issue in an aging workforce. Educators involved in vocational education teacher training mentioned one or both of these factors as possible causes of future shortages during the course of our informal interviews:

> Vocational teachers are retiring, and there aren't any to take their place.

> The projected retirement of vocational teachers is going to be a big problem. Competition from industry is also a huge problem. Entry-level pay may be equivalent, but the growth potential for salaries in industry is much, much greater than for teaching.

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[12] In some cases, a provisional or temporary certificate can be renewed.

[13] Since not every state provides information on certification requirements for vocational education, some states are omitted from our analysis.

The issue of the attrition of teachers from the profession as a whole has been relatively well-researched. Although there are no behavioral studies that have explicitly focused on vocational education teachers, several studies over the past two decades have developed behavioral models of teacher attrition and have contributed to an understanding of the role that individual and district characteristics play in determining rates of attrition (e.g., Brewer, 1996; Grissmer & Kirby, 1987, 1992; Kirby, Naftel, & Berends, 1999; Murnane & Olsen, 1989; Murnane, Singer, & Willett, 1988, 1989). Of the many factors, such as age, sex, ability, education, experience, marital and parental status, teaching field, district salary levels, career paths, found to be relevant to the prediction of attrition, we focus upon an analysis of attrition with respect to age and experience due to data constraints. Prior research indicates that attrition rates tend to follow a U-shaped pattern with respect to age, with the highest rates experienced by the youngest and the oldest teachers (Garcia, 1983; Greenberg & McCall, 1973; Grissmer & Kirby, 1987; Harnischfeger, 1973; Jacobsen & Sweet, 1982; Mark & Anderson, 1978; Pederson, 1970; Tomlinson, Pontius, & Kolesar, 1981).

We do not utilize behavioral attrition models in this study, but we present tables and plots showing the proportion of vocational education teachers who exit teaching by age and experience level at various points in cross-sectional data, and we present survival rates (the proportion of teachers that are still teaching after a specific number of years) using longitudinal data from Texas. Barro (1992) notes that these rates may differ for different cohorts of teachers over time. We therefore provide this analysis for more than one teaching cohort in Texas.

Indicators of Demand

In the conceptual framework outlined in the preceding chapter, it was stated that future trends in the demand for vocational education teachers could be predicted if the structure of district preferences regarding the vocational education curriculum and method of instruction were known and if information on student enrollments and the costs of employing these teachers were available. As stated previously, a model of district behavior is beyond the scope of this report. We instead provide information on factors believed to exert a strong influence on the demand for vocational education. The first of these is student enrollments. Other factors deemed relevant are pupil-teacher ratios, vocational education course taking, and funding sources. We investigate each of these factors to the extent that our data and the scope of this report permit.

Enrollment Trends

Enrollments of students in public secondary schools are tracked beginning in the early 1980s, and NCES projections to the year 2008 are presented. Enrollment trends by region and state are presented, as well as

trends by race. Although no existing report publishes enrollment projections by race, we provide U.S. Bureau of the Census projections indicating the population trajectories that will be followed by various racial groups.

Pupil-Teacher Ratios

Trends over time in average pupil-teacher ratios in public secondary schools are presented, with disaggregations by region and state. Data sources are again NCES publications. In addition, data from the SASS and from New York State enable us to track the average number of pupils in vocational education classes and to compare this with the average number of pupils in nonvocational classes. We conduct statistical tests of the difference between the two types of classes.

Course-Taking Patterns

Trends in the high school curriculum reform are often the result of state policy changes that may occur in response to federal pressures, legislative efforts, and judicial reform, as indicated in the conceptual framework presented in the previous chapter. As mentioned previously, these can also reflect trends in the larger economy and in the choices made by students. An assumption embodied in policy statements like *A Nation at Risk* (National Commission on Excellence in Education, 1983) was that individuals with greater academic skills would be better suited to the nation's workforce needs than others. The fact that the returns to a college education rose considerably in the 1980s (Kane & Rouse, 1995) seems to support this notion. Student preferences for college education appeared to respond positively to the rising relative wage during the same decade. Sixty-three percent of 1991 graduates went into higher education, as opposed to 49% in 1980 (Gray, 1996). Gray (1996) and Gray and Herr (1995) characterize these changes as a kind of "college mania" in which students and their parents believe college is the "best way to win." The stated motivations of today's college entrants, as reported by the Higher Education Research Institute (1994), appear to confirm this supposition. The following statement of an educator involved in vocational education teacher training concurs:

> With our policymakers, the key decision group is the state legislature. In the blink of an eye they can pass legislation with wide-ranging effects. They came up with sweeping mandates that have increased academic requirements. That's eliminated room for any electives, which for many students is vocational education. . . . I think that the general track has almost evaporated. Of course, it leads nobody nowhere. What has replaced it is you've got Tech Prep and the university track, and people think the Tech Prep track is "not for my kid." I think it's parents and the legislature, and guidance counselors, and academic teachers—all subconsciously

and consciously conspiring together to drop this subtle message that there's only one way to success.

There is some evidence, however, that within the group of students who do not pursue postsecondary education, those whose course of studies included vocational education coursework, achieve higher immediate returns to education (Mane, 1999). A model of student behavior encompassing these choices is difficult to create in light of the fact that the choices are highly constrained by requirements imposed by the state and the curriculum offered by schools.

We therefore examine course-taking patterns relating to vocational education directly and attempt to infer motivations from the "revealed preferences" supplied in published data. We reproduce and provide graphical representations of data on course-taking trends reported by the U.S. Department of Education for the time period spanning from 1982 to 1994. Various approaches to disaggregation enable us to uncover the underlying factors driving the demand for vocational education.

Trends in both the participation in vocational education programs (i.e., the degree to which students specialize in vocational education) and in the overall acquisition of vocational education course units are examined. As a route to understanding the origin of trends, we disaggregate high school course-taking data by sex and race.

In examining course-taking patterns, it is important not to ascribe trends exclusively to demand-related factors. Lowered rates of enrollments in particular courses may occur when these courses are not offered due to the inability of districts to find teachers to teach them. Thus, a phenomenon that would appear to indicate decreased demand might, in fact, stem from a decrease in supply. The data supplied do not allow us to distinguish between these two scenarios. Data distinguishing the two scenarios would include information on the curriculum available to each student as well as information pertaining to their choices.

Funding

As mentioned in the exposition of our conceptual framework, funding sources and formulas will be likely to affect district behavior regarding the employment of vocational education teachers.

Data collection on the amount of local and state funding devoted to vocational education programs was beyond the scope of this project. Records of changes in federal funding are available in published data; however, fluctuations in these sources are likely to have played a role in producing trends in the demand for vocational education. We therefore summarize and display trends in federal funding using data reported in the *Digest of Education Statistics* (U.S. Department of Education, 1997). The investigation of trends in funding sources, particularly how districts utilize

funding from various sources and co-mingle or substitute funds is an important area of future research.

Shortages or Surpluses

In addition to the direct comparison of supply and demand forecasts, shortages, in particular, can be assessed directly if districts report with accuracy on the numbers of unfilled vacancies they incur in vocational education subject areas. We therefore add the following indicator to our list:

- The number and persistence of vacancies

As Haggstrom, Darling-Hammond, and Grissmer (1988) point out, because of the time lag between the creation of a new position and the filling of the position, vacancies will occur regardless of whether or not shortage or surplus conditions exist. It is therefore necessary to measure the duration or persistence of vacancies in order to obtain a meaningful indicator of shortages. We attempt to obtain a direct assessment of shortages through SASS reports of unfilled vacancies and their persistence.

Our prior conceptual discussion of the manifestations of disequilibrium conditions in a labor market characterized by wage and employment rigidities indicated that increases in salaries, increases in pupil-teacher ratios, decreases in teacher quality, and decreases in barriers to entry into the profession might be expected signs of a shortage. A surplus would be expected to produce the opposite set of phenomena. In our discussion section, we bring together our findings with respect to the following indicators in order to assess whether impending shortages or surpluses of vocational education teachers can be detected:

- Real salaries
- Other forms of compensation
- Pupil-teacher ratios
- "Quality" indicators such as education and experience
- Barriers to entry (i.e., changes in certification requirements over time)

In general, we examine trends in these indicators where possible[14] to determine whether there is evidence that points towards shortages or surpluses.

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[14]Unfortunately, data on alternative forms of compensation are lacking in all datasets.

CHAPTER IV

Findings

In this chapter, we present our findings on each of our key indicators. Our first stated goal was to present a statistical profile of the nation's public secondary vocational education teachers in answer to the question, "Who is teaching vocational education?" Section 1 presents information on the growth and decline in the numbers of vocational education teachers nationwide and their proportions relative to other teachers in the educational system. Sections 2 through 8 present information on the characteristics of vocational education teachers and how they differ from nonvocational education teachers. Our second goal was to report upon movements in factors underlying the supply of and demand for vocational education teachers. Sections 9 through 15 present information on trends in certification requirements, enrollments, pupil-teacher ratios, vocational education course taking, the influx of new teachers, and attrition. Last, in the attempt to uncover direct evidence of shortage of teachers in various vocational education fields, we present statistics on school-level reports regarding the existence and persistence of vacancies in Section 16.

Growth and Decline in the Numbers of Vocational Education Teachers

1. The Number of Vocational Education Teachers

National data show a decline in both the absolute and relative number of vocational education teachers. Among secondary school teachers, vocational education teachers accounted for about 12% of the total teaching pool in 1994 as opposed to 16% in 1988 (see Table 4.1.1). In 1988, 89% of vocational education teachers taught in comprehensive high schools and 11% taught in vocational schools. In 1994, the percentage of vocational education teachers in vocational schools had fallen to 8% (see Table 4.1.2).

Table 4.1.1. Number of Public Secondary School Vocational Education Teachers and Proportion of All Teachers Who Are Vocational Education Teachers, Nationwide, by Year

Year	*Vocational Education Teachers*	*Proportion of All Teachers*	*Nonvocational Education Teachers*
1988	165,075	0.16	873,380
1991	149,738	0.16	757,927
1994	141,019	0.12	1,000,400

Source: Schools and Staffing Survey

Table 4.1.2. Number and Proportion of Vocational Education Teachers Who Teach in Comprehensive High Schools Versus Vocational Schools, Nationwide, by Year

Year	*Comprehensive*	*Proportion*	*Vocational*	*Proportion*
1988	147,042	0.89	18,033	0.11
1991	135,472	0.90	14,266	0.10
1994	130,321	0.92	10,698	0.08

Source: Schools and Staffing Survey

It is somewhat problematic to identify trends in the growth or decline of particular subfields at the national level due to changes in the subfield classifications used by the SASS after 1988. The 1988 survey did not include several vocational education subfields as separate categories. Based on data from the two most recent years of the SASS, it appears that all fields grew slightly between 1991 and 1994, except business, which experienced a substantial decline (see Table 4.1.3 and Figure 4.1.1).

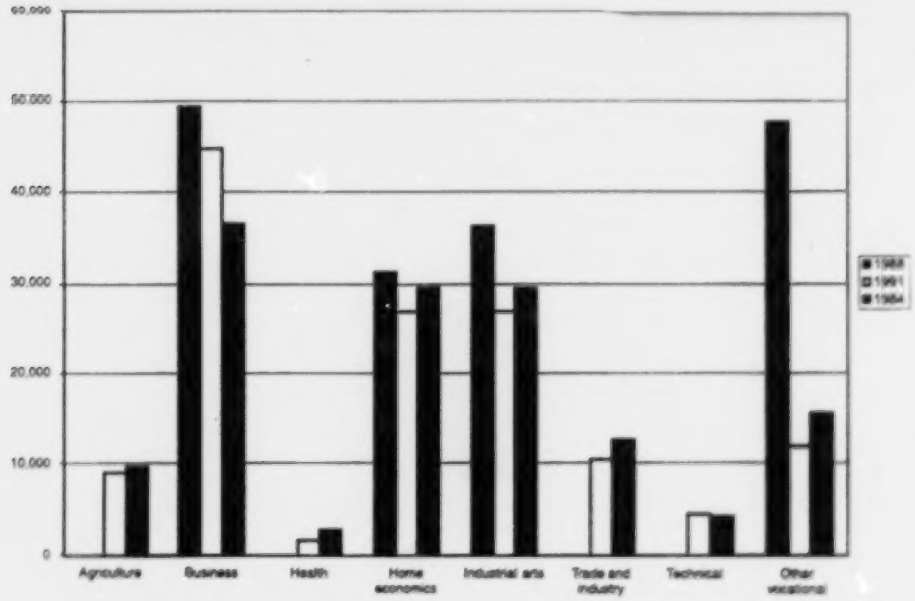
Table 4.1.3. Number of Vocational Education Teachers in Each Vocational Education Subfield, Nationwide, by Year

	Agriculture	*Business*	*Health*	*Home Economics*	*Industrial Arts*	*Trade and Industry*	*Other Technical*	*Vocational*
1988	-	49,523	-	31,364	36,317	-	-	47,872
1991	9487	46,385	2,521	28,211	29,384	14,318	4,380	15,051
1994	9,871	36,665	2,820	29,614	29,614	12,692	4,231	15,512

Source: Schools and Staffing Survey
Note: Some vocational education subfields were not specified in the 1987-1988 SASS. Blank entries represent subfields not surveyed.

This national picture is confirmed by our state sources. Vocational education in Texas is marked by both absolute and relative declines in the teaching force, with vocational education teachers accounting for 4% of secondary school teachers in 1996, compared with 7% in 1988 (see Table 4.1.4).

Figure 4.1.1. Number of Teachers in Each Vocational Education Subfield, Nationwide, by Year



Source: Schools and Staffing Survey

Table 4.1.4. Number of Vocational Education Teachers and Proportion of All Teachers Who Are Vocational Education Teachers, in Texas, by Year

Year	*Number of Vocational Education Teachers*	*Number of All Teachers*	*Vocational Proportion of Total*
1988	12,329	183,166	0.07
1989	11,509	191,503	0.06
1990	11,334	204,093	0.06
1991	11,790	210,049	0.06
1992	11,993	215,992	0.06
1993	12,087	222,684	0.05
1994	12,468	229,469	0.05
1995	10,563	238,651	0.04
1996	10,743	244,428	0.04

Source: Texas Education Agency

In New York, the pattern of decline is again evident, with vocational education teachers accounting for 8% of all teachers in 1980 and 5% in 1998 (see Table 4.1.5). With respect to the various vocational education subfields, the New York data are comparable to the other datasets only after 1990. It appears that between 1990 and 1998, the largest declines have occurred in technology (this is the term used for the field of industrial arts in New York), business, and home economics.

Table 4.1.5. Number of Vocational Education Teachers and Proportion of All Teachers Who Are Vocational Teachers, in New York, by Year

	Number of Vocational Education Teachers	*Number of All Teachers*	*Vocational Proportion of Total*
1980	13,806	162,632	0.08
1985	11,842	160,432	0.07
1990	10,566	174,133	0.06
1995	9,115	178,191	0.05
1998	8,754	185,139	0.05

Source: New York Personnel Master File

Demographic Characteristics of Vocational Education Teachers

In Sections 2 through 4 we report on the sex, race, and age of vocational education teachers relative to other types of teachers and on trends in these characteristics over time.

2. Percent Female

Examining the demographic composition of vocational education teachers is useful because, as can be seen in Table 4.2.1, vocational education teachers are evenly split between the two sexes in our nation's vocational education teaching force, and the numbers reveal that there are more men teaching vocational education courses, as a percentage, than teaching academic fields. The male presence in the vocational education teaching force is even higher in vocational education schools, which are about two-thirds male (see Appendix 4.2.2).

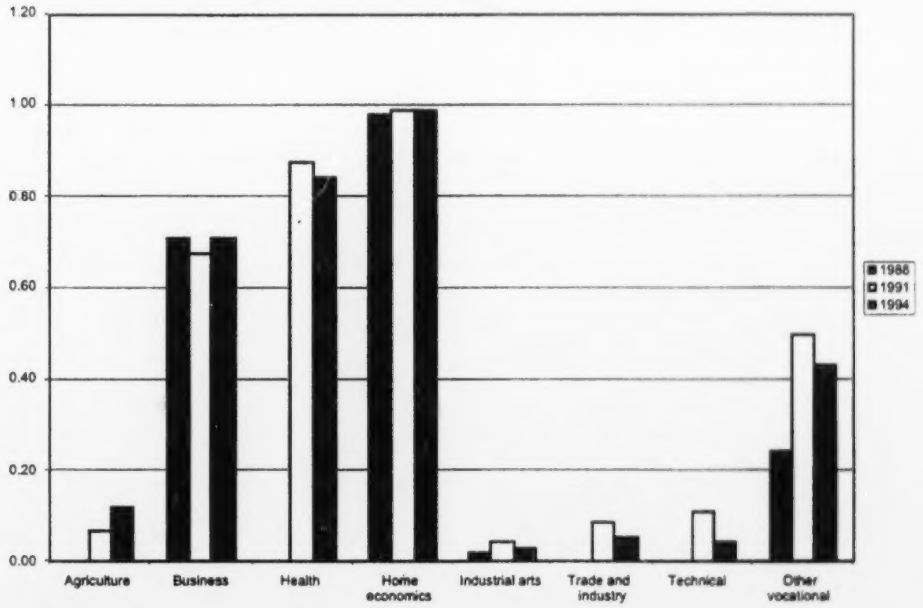
Table 4.2.1. Proportion of Teachers Who Are Female, Vocational Versus Nonvocational Education Teachers, Nationwide, by Year

Year	*Vocational*	*Nonvocational*	*Difference*
1988	0.47	0.54	-0.06
1991	0.48	0.55	-0.07
1994	0.48	0.57	-0.09

Source: Schools and Staffing Survey

The vocational education teaching force is marked by occupational segregation across vocational education subspecialties (see Figure 4.2.1 and Appendix 4.2.3). Some are almost exclusively male (e.g., industrial arts, trade and industry), while some (e.g., home economics) are almost exclusively female. In no field is there an even balance between male and female teachers.

Figure 4.2.1. Proportion of Teachers Who Are Female in Each Vocational Education Subfield, Nationwide, by Year

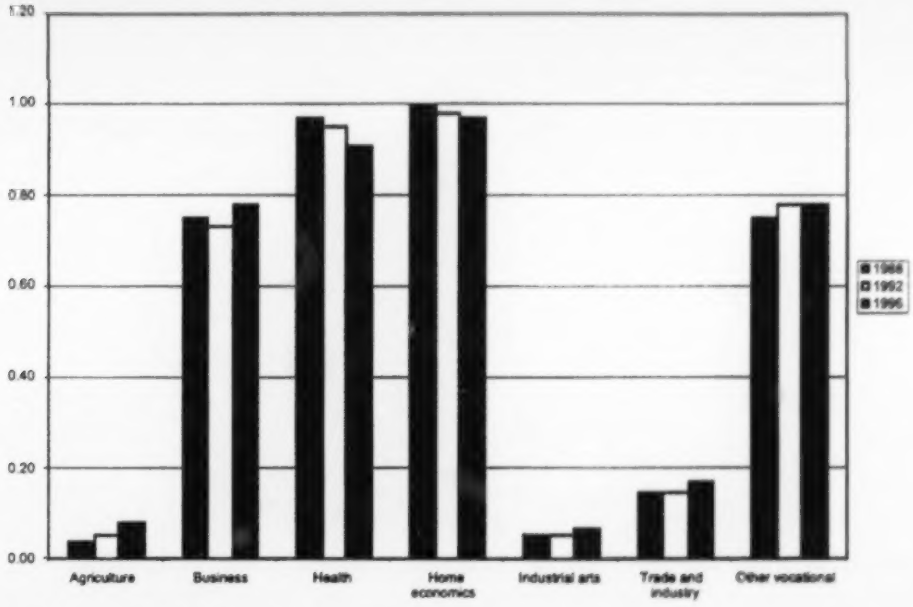


Source: Schools and Staffing Survey

In Texas, the difference between vocational and nonvocational education fields is more pronounced (see Appendix 4.2.4). Academic fields are clearly dominated by female teachers, who represent about 80% of the total. Vocational education teachers are fairly evenly split between male and female teachers.

The distribution of sex across specialties in Texas is similar to that of the nation as a whole (Figure 4.2.2 and Appendix 4.2.5). Business, health, and home economics are dominated by female teachers, while agriculture, industrial arts, and trade and industry are dominated by male teachers. It appears that a very slight movement away from segregation is occurring in almost all identifiable fields.

Figure 4.2.2. Proportion of Teachers Who Are Female in Each Vocational Education Subfield, in Texas, by Year



Source: Texas Education Agency

In New York, the teaching profession has been, in general, less feminized than in Texas (see Appendix 4.2.6). In 1980, 41% of vocational education teachers were female, and in 1998, 46% were female. Nonvocational education teachers, on the other hand, were mostly female: 62% in 1980 and 73% in 1998. Over time, there has been a tendency towards feminization. The distribution of sex across subfields in New York is very similar to that of Texas (see Appendix 4.2.7 and Appendix Figure 4.2.3).

3. Percent Nonwhite

Nationally, the ethnic makeup of vocational education high school teachers is not significantly different from that of nonvocational education high school teachers, nor is there a significant difference between teachers in vocational schools and their counterparts in comprehensive high schools (see Appendix 4.3.1 and Appendix 4.3.2).

There was some variation in racial composition across vocational education subfields (see Appendix 4.3.3). At the national level, health was the only field below average in its percentage of nonwhite teachers. Business, home economics, industrial arts, and technical were well above average.

In Texas, the racial composition of vocational education teachers differed from that of nonvocational education teachers by very few percentage points on average (see Appendix 4.3.4). Nonwhite teachers accounted for about a fifth of vocational education teachers in Texas overall, higher than the national average of 13%.

In Texas, while the percentage of nonwhite vocational education teachers was close to the statewide average in most subfields, agriculture showed a very low percentage—below even the national average (see Appendix 4.3.5). Although the percentage of nonwhite agriculture teachers increased over time, it remained below the national average and considerably below the state average. Health, business, and trade and industry, in contrast, had percentages of nonwhite teachers much higher than the state average.

No data on race were available from the New York dataset.

4. Age

Vocational education teachers are somewhat older on average than nonvocational education teachers, about two years older according to data at the national level (see Table 4.4.1). The difference is highly significant. The mean age for both groups has risen slightly over the six-year period. The rate of growth in age for the vocational education teaching force is slightly higher than that of the nonvocational education teaching force.

Table 4.4.1. Mean Age of Teachers, Vocational Versus Nonvocational Education Teachers, Nationwide, by Year

Year	*Vocational*	*Nonvocational*	*Difference*	*p > |t|*
1988	43.5	41.5	2.0	0.000
	(0.18)	(0.08)		
1991	44.7	42.9	1.8	0.000
	(0.19)	(0.10)		
1994	44.9	43.0	1.9	0.000
	(0.21)	(0.09)		

Source: Schools and Staffing Survey
Note: Standard errors are reported in parentheses.

As can be seen in Table 4.4.2, vocational education teachers in vocational schools are significantly older than their counterparts in comprehensive high schools.

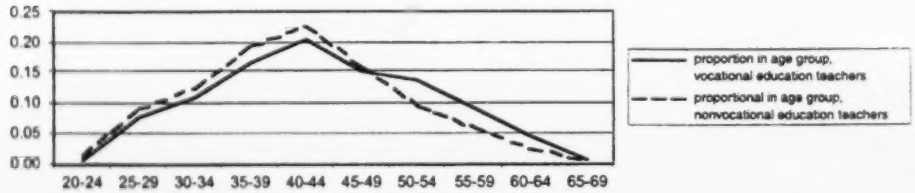
Table 4.4.2. Mean Age of Teachers, Vocational Education Teachers in Comprehensive High Schools Versus Teachers in Vocational Schools, Nationwide, by Year

Year	*Comprehensive*	*Vocational*	*Difference*	*p > |t|*
1988	43.2 (0.19)	45.6 (0.47)	-2.5	0.000
1991	44.5 (0.21)	46.1 (0.42)	-1.6	0.001
1994	44.8 (0.22)	47.0 (0.64)	-2.3	0.001

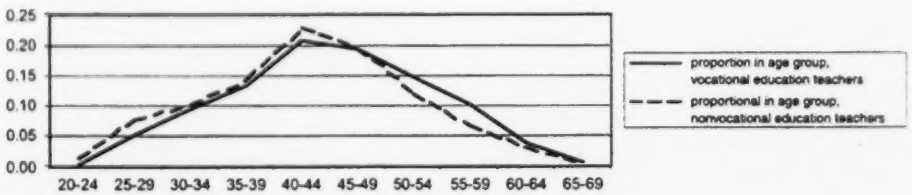
Source: Schools and Staffing Survey
Note: Standard errors are in parentheses.

Figure 4.4.1. Proportion of Teachers in Each Age Group, Vocational Versus Nonvocational Education Teachers

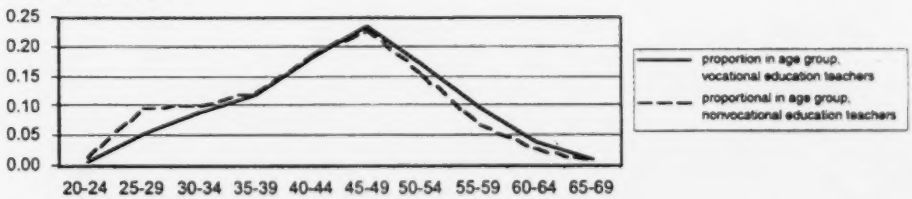
Part A: 1988



Part B: 1991



Part C: 1994



Source: Schools and Staffing Survey

Table 4.4.3 and Figure 4.4.1 show how the age distribution of vocational and nonvocational education teachers changed over a five-year period. In 1988, the age distribution for vocational education teachers showed a slightly greater variance than that of nonvocational education teachers and contained a higher proportion of teachers in the 45-65 age group. By 1994, however, the difference in the proportion of teachers in the 45-65 group had begun to diminish, but a noticeable difference in the proportion of young teachers has arisen. The overall picture in 1993 appears to be one in which vocational education teachers tend to be older, less because a larger demographic is approaching retirement than because there are fewer younger teachers. The age distribution curves for the three years of the SASS show a distinctive and growing bulge of younger nonvocational education teachers, in contrast to those for vocational education teachers, which show no such bulge. In 1994, there appears to be a growing bulge of 20- to 30-year-old nonvocational education teachers, but no corresponding bulge for vocational education teachers.

Table 4.4.3. Distribution of Teacher Ages, Vocational Versus Nonvocational Education Teachers, Nationwide, by Age Group and Year

	1988		*1991*		*1994*	
Age Group	*Vocational*	*Non-vocational*	*Vocational*	*Non-vocational*	*Vocational*	*Non-vocational*
20-24	0.01	0.01	0.01	0.01	0.01	0.01
25-29	0.08	0.09	0.05	0.08	0.05	0.10
30-34	0.11	0.12	0.10	0.10	0.09	0.10
35-39	0.17	0.19	0.14	0.15	0.12	0.12
40-44	0.21	0.23	0.21	0.23	0.18	0.19
45-49	0.15	0.16	0.19	0.20	0.23	0.23
50-54	0.14	0.10	0.15	0.12	0.17	0.15
55-59	0.09	0.06	0.10	0.07	0.10	0.07
60-64	0.04	0.03	0.04	0.03	0.04	0.03
65-69	0.01	0.00	0.01	0.01	0.01	0.01

Source: Schools and Staffing Survey

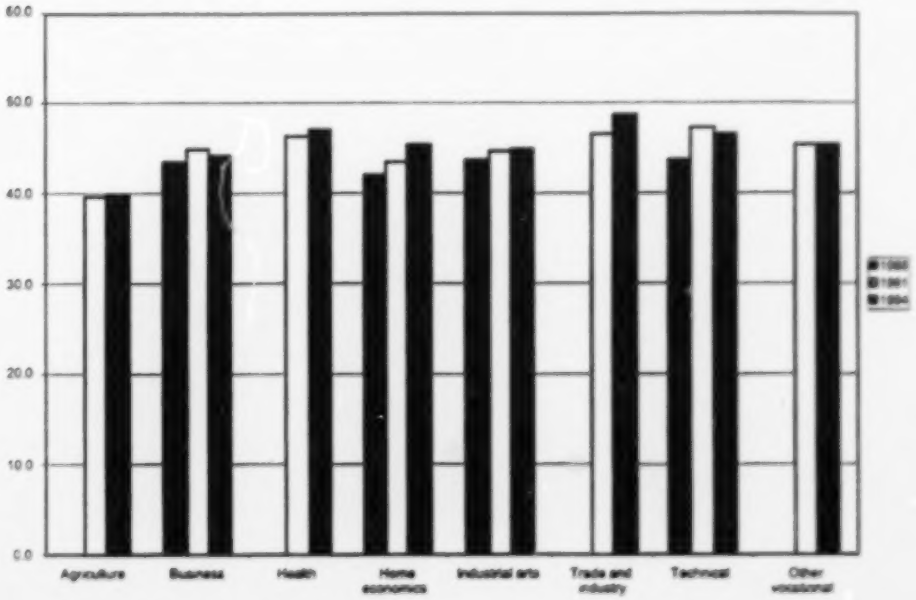
Mean age varies across vocational subfields (see Table 4.4.4 and Figure 4.4.2). Agriculture teachers tend to be the youngest. Health, trade and industry, and technical teachers tend to be oldest, with the latter two groups of teachers showing a faster rate of age growth over time. Teachers in other fields are, on average, around 43-46 years old.

Table 4.4.4. Mean Age of Teachers in Each Vocational Education Subfield, Nationwide, by Year

	Agriculture	*Business*	*Health*	*Home Economics*	*Industrial Arts*	*Trade and Industry*	*Technical*	*Other Vocational*
1988	—	43.6	—	42.2	43.8	—	43.9	
1991	39.9	45.0	46.3	43.5	44.8	46.7	47.3	45.5
1994	*40.0*	*44.3*	*46.9*	*45.3*	*44.9*	*48.8*	*46.7*	*45.4*

Source: Schools and Staffing Survey
Note: Some vocational education subfields were not specified in the 1987-1988 SASS. Blank entries represent subfields not surveyed.

Figure 4.4.2. Mean Age of Teachers in Each Vocational Education Subfield, Nationwide, by Year



Source: Schools and Staffing Survey

For Texas teachers, the picture is broadly similar. The difference in age between vocational and nonvocational education teachers is somewhat higher for the universal dataset of Texas teachers, due primarily to the relative youth of the Texas nonvocational teaching force (Appendix 4.4.5). In 1988, the average Texas vocational education teacher was two and a half years older than the average Texas nonvocational education teacher. The difference continued to grow over the next eight years, reaching three and a half years by 1996. Again, the difference was highly significant in all years.

The distribution of age by subfield is similar in Texas to that of the nation, as a whole (see Appendix 4.4.6). Again, agriculture teachers are the youngest, whereas trade and industry teachers are, in general, the oldest. Nearly all fields, with the exception of health, appear to be steadily aging.

The age distribution of vocational education teachers in New York is similar in all respects to that of the nation, as a whole, and of Texas (see Appendix 4.4.7). Vocational education teachers are significantly older than nonvocational education teachers, and, as a group, they are aging as time progresses.

Education and Experience

Sections 5 through 7 contain information regarding the educational attainment and teaching experience of vocational education teachers, both relative to other types of teachers and as trends over time. In addition, we provide information on the proportions of vocational education teachers with industry experience.

5. Educational Attainment

At the national level, the average educational attainment of vocational education teachers is slightly lower than that of nonvocational education teachers. A small proportion of vocational education teachers—about 6% in 1996—possessed no bachelor's degree (see Table 4.5.1, Part A). Nonvocational education teachers were more likely to have obtained a post-graduate degree as well. In 1994, around 51% of nonvocational education teachers had acquired master's degrees or higher, compared with 45% of vocational education teachers (Table 4.5.1, Part C).

Table 4.5.1. Proportion of Teachers at Each Level of Degree Attainment, Vocational Versus Nonvocational Education Teachers, Nationwide, by Year

Year	*Vocational*	*Nonvocational*	*Difference*
A. Less than a bachelor's degree			
1988	0.02	0.00	0.02
1991	0.06	0.00	0.06
1994	0.06	0.00	0.05
B. Bachelor's degree			
1988	0.51	0.47	0.04
1991	0.49	0.48	0.01
1994	0.49	0.49	0.00
C. Post-graduate degree			
1988	0.47	0.53	-0.06
1991	0.44	0.51	-0.07
1994	0.45	0.51	-0.06

Source: Schools and Staffing Survey

The difference in degree attainment between vocational education teachers in comprehensive high schools versus those in vocational schools is shown in Table 4.5.2. Those in comprehensive high schools possessed a substantially higher level of formal education.

Table 4.5.2. Proportion of Teachers at Each Level of Degree Attainment, Vocational Education Teachers in Comprehensive High Schools Versus Teachers in Vocational Schools, Nationwide, by Year

Year	*Comprehensive*	*Vocational*	*Difference*
A. Less than a bachelor's degree			
1988	0.01	0.10	-0.09
1991	0.03	0.34	-0.30
1994	0.03	0.35	-0.32
B. Bachelor's degree			
1988	0.49	0.62	-0.13
1991	0.50	0.46	0.04
1994	0.50	0.36	0.14
C. Post-graduate degree			
1998	0.50	0.28	0.22
1991	0.46	0.25	0.21
1994	0.47	0.29	0.18

Source: Schools and Staffing Survey

The percentage of vocational education teachers in Texas with no bachelor's degree exceeded the national average but decreased from 10% in 1988 to 8% in 1996 (see Table 4.5.4). The average vocational education teacher in Texas had a significantly lower level of attainment of the bachelor's than the average nonvocational education teacher but was significantly more likely to possess a post-graduate degree. This is due to the fact that relatively fewer Texas teachers possess post-graduate degrees than is the case nationwide.

Across vocational education fields, trade and industry and health teachers were less likely to have attained the bachelor's degree level in Texas (see Table 4.5.5). This is probably due to the fact that many nursing and allied health profession licenses can be obtained at the associate degree level and that many trades can be learned through an associate degree or an apprenticeship.

Table 4.5.4. Proportion of Vocational Education Teachers and Proportion of Nonvocational Education Teachers at Each Level of Degree Attainment, in Texas, by Year

Year	*Vocational*	*Nonvocational*	*Difference*
A. Less than a bachelor's degree			
1988	0.10	0.02	0.08
1989	0.09	0.01	0.08
1990	0.08	0.01	0.08
1991	0.09	0.01	0.07
1992	0.08	0.01	0.07
1993	0.08	0.01	0.07
1994	0.07	0.00	0.06
1995	0.08	0.01	0.07
1996	0.08	0.01	0.07
B. Bachelor's degree			
1988	0.49	0.64	-0.15
1989	0.52	0.66	-0.14
1990	0.52	0.67	-0.15
1991	0.53	0.68	-0.15
1992	0.54	0.69	-0.15
1993	0.55	0.70	-0.15
1994	0.56	0.71	-0.15
1995	0.56	0.71	-0.15
1996	0.57	0.72	-0.15
C. Post-graduate degree			
1988	0.34	0.32	0.02
1989	0.35	0.32	0.03
1990	0.35	0.32	0.03
1991	0.35	0.31	0.04
1992	0.34	0.30	0.04
1993	0.33	0.29	0.04
1994	0.33	0.29	0.05
1995	0.31	0.28	0.03
1996	0.30	0.27	0.03

Source: Texas Education Agency

Table 4.5.5. Proportion of Teachers at Each Level of Degree Attainment in Each Vocational Education Subfield, in Texas, by Year

Year	Agriculture	Business	Health	Home Economics	Industrial Arts	Trade and Industry	Other Vocational
A. Less than a bachelor's degree							
1988	0.01	0.02	0.14	0.02	0.03	0.34	0.08
1989	0.00	0.02	0.10	0.01	0.01	0.32	0.06
1990	-	0.00	0.12	0.01	0.01	0.33	0.05
1991	0.00	0.00	0.14	0.01	0.01	0.33	0.05
1992	-	-	0.11	0.00	0.01	0.33	0.04
1993	0.00	0.01	0.13	0.00	0.01	0.33	0.04
1994	0.00	0.00	0.10	0.00	0.01	0.32	0.03
1995	0.00	0.01	0.11	0.01	0.01	0.33	0.02
1996	0.00	0.01	0.14	0.00	0.01	0.33	0.02
B. Bachelor's degree							
1988	0.46	0.58	0.50	0.65	0.52	0.37	0.47
1989	0.46	0.57	0.53	0.65	0.52	0.40	0.49
1990	0.48	0.60	0.49	0.67	0.52	0.39	0.51
1991	0.50	0.63	0.45	0.67	0.54	0.38	0.52
1992	0.50	0.63	0.54	0.67	0.54	0.39	0.54
1993	0.52	0.63	0.52	0.68	0.54	0.39	0.55
1994	0.54	0.67	0.58	0.68	0.55	0.41	0.55
1995	0.55	0.66	0.60	0.68	0.56	0.41	0.59
1996	0.56	0.71	0.58	0.69	0.57	0.40	0.61
C. Post-graduate degree							
1988	0.44	0.39	0.24	0.29	0.42	0.20	0.40
1989	0.47	0.42	0.25	0.32	0.44	0.22	0.44
1990	0.45	0.39	0.28	0.31	0.44	0.20	0.42
1991	0.43	0.37	0.31	0.31	0.42	0.21	0.42
1992	0.42	0.37	0.26	0.30	0.42	0.21	0.41
1993	0.40	0.36	0.27	0.30	0.42	0.20	0.40
1994	0.39	0.32	0.25	0.30	0.42	0.18	0.41
1995	0.37	0.32	0.23	0.29	0.41	0.18	0.38
1996	0.37	0.27	0.22	0.29	0.39	0.17	0.36

Source: Texas Education Agency
Note: Some vocational education subfields were not specified in the 1987-1988 SASS. Blank entries represent subfields not surveyed.

In New York, vocational education teachers showed higher proportions of teachers without and with a bachelor's degree, but lower levels of teachers with post-graduate degrees (Table 4.5.6). Health and trade teachers were the most likely to have less than a bachelor's degree (Table 4.5.7).

Table 4.5.6. Proportion of Teachers at Each Level of Degree Attainment, Vocational Versus Nonvocational Education Teachers, in New York, by Year

Year	*Vocational*	*Nonvocational*	*Difference*
A. Less than a bachelor's degree			
1980	0.11	0.00	0.11
1985	0.10	0.00	0.10
1990	0.09	0.00	0.09
1995	0.08	0.00	0.08
1998	0.08	0.00	0.08
B. Bachelor's degree			
1980	0.38	0.35	0.03
1985	0.36	0.32	0.04
1990	0.33	0.31	0.01
1995	0.29	0.26	0.03
1998	0.28	0.24	0.04
C. Post-graduate degree			
1980	0.51	0.64	-0.14
1985	0.54	0.68	-0.13
1990	0.59	0.68	-0.10
1995	0.63	0.74	-0.12
1998	0.64	0.76	-0.12

Source: New York Personnel Master File

Table 4.5.7. Proportion of Teachers at Each Level of Degree Attainment in Each Vocational Education Subfield, in New York, by Year

Year	*Trade*	*Technical*	*Technology*	*Agriculture*	*Business and Marketing*	*Home Economics*	*Health*	*Other*
A. Less than a bachelor's degree								
1980	0.51	0.27	0.04	0.13	0.01	0.04	0.25	0.05
1985	0.46	0.25	0.02	0.13	0.01	0.04	0.18	0.08
1990	0.43	0.19	0.02	0.10	0.01	0.07	0.21	0.02
1995	0.42	0.12	0.01	0.08	0.00	0.08	0.20	0.02
1998	0.40	0.13	0.02	0.13	0.00	0.07	0.22	0.01
B. Bachelor's degree								
1980	0.33	0.35	0.41	0.56	0.35	0.41	0.44	0.33
1985	0.35	0.26	0.38	0.54	0.33	0.37	0.42	0.29
1990	0.35	0.35	0.33	0.47	0.29	0.30	0.36	0.34
1995	0.35	0.30	0.29	0.40	0.23	0.28	0.39	0.29
1998	0.37	0.30	0.26	0.37	0.23	0.26	0.34	0.27
C. Post-graduate degree								
1980	0.16	0.38	0.56	0.30	0.64	0.55	0.31	0.62
1985	0.19	0.48	0.60	0.33	0.66	0.59	0.40	0.63
1990	0.22	0.45	0.66	0.43	0.71	0.63	0.43	0.64
1995	0.23	0.58	0.70	0.52	0.76	0.65	0.42	0.69
1998	0.24	0.57	0.72	0.50	0.77	0.66	0.44	0.71

Source: New York Personnel Master File
Note: Some vocational education subfields were not specified in the 1987-1988 SASS. Blank entries represent subfields not surveyed.

6. Teaching Experience

On average, vocational education teachers have slightly more teaching experience than nonvocational education teachers (see Table 4.6.1). The mean amount of total experience for vocational education teachers in 1994 was about 16½ years, compared to 15 years for nonvocational education teachers.

Table 4.6.1. Mean Years of Teaching Experience of Teachers, Vocational Versus Nonvocational Education Teachers, Nationwide, by Year

Year	*Vocational*	*Nonvocational*	*Difference*	*p > |t|*
1988	14.80 (0.16)	14.00 (0.16)	0.8	0.000
1991	15.96 (0.18)	15.04 (0.09)	0.93	0.000
1994	16.38 (0.21)	14.89 (0.09)	1.49	0.000

Source: Schools and Staffing Survey
Note: Standard errors are in parentheses.

Vocational education teachers in comprehensive high schools had a significantly higher level of public school teaching experience than their counterparts in vocational schools (see Table 4.6.2).

Table 4.6.2. Mean Years of Teaching Experience of Teachers, Vocational Education Teachers in Comprehensive High Schools Versus Teachers in Vocational Schools, Nationwide, by Year

Year	*Comprehensive*	*Vocational*	*Difference*	*p > |t|*
1988	15.1 (0.17)	12.0 (0.34)	3.1	0.000
1991	16.3 (0.19)	12.7 (0.35)	3.6	0.000
1994	16.6 (0.23)	13.9 (0.56)	2.6	0.000

Source: Schools and Staffing Survey
Note: Standard errors are in parentheses.

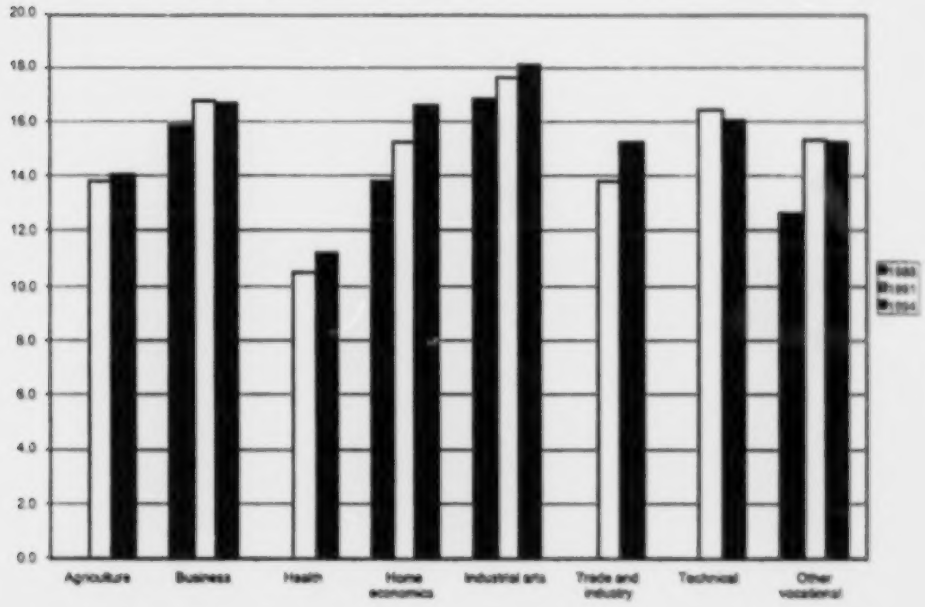
The breakdown of public school experience by vocational fields is displayed in Table 4.6.3 and Figure 4.6.1. The field with the least experience was health. Industrial arts teachers had the most experience. Almost all fields displayed an increase in average experience levels over time.

Table 4.6.3. Mean Years of Teaching Experience of Teachers in Each Vocational Education Subfield, Nationwide, by Year

Year	Agriculture	Business	Health	Home Economics	Industrial Arts	Trade and Industry	Technical	Other Vocational
1988		15.9		13.9	16.8			12.7
1991	13.9	16.8	10.5	15.3	17.7	13.8	16.5	15.4
1994	14.1	16.7	11.3	16.6	18.1	15.3	16.1	15.3

Source: Schools and Staffing Survey
Note: Some vocational education subfields were not specified in the 1987-1988 SASS. Blank entries represent subfields not surveyed.

Figure 4.6.1. Mean Years of Teaching Experience in Each Vocational Education Subfield, Nationwide, by Year



Source: Schools and Staffing Survey

In Texas, the relative amount of teaching experience possessed by the average vocational education teacher versus that of the average nonvocational education teacher was even greater than it was at the national level (see Appendix 4.6.4). This difference grew between 1988 and 1996. Note that, on average, teachers in Texas have less teaching experience than teachers nationwide.

The picture of teacher experience by vocational education subfield was similar in Texas to that nationwide (see Appendix 4.6.5 and Appendix Figure

4.6.2). Health was again the profession with the least amount of teaching experience, and industrial arts was the profession with the most. In addition, the experience level of health teachers decreased over time, whereas it increased for most of the other groups, most notably home economics and industrial arts.

Vocational education teachers in New York possessed only slightly higher levels of teaching experience than nonvocational education teachers, but the difference was significant and it grew over time (see Appendix 4.6.6). Health was again the field with the least amount of experience (see Appendix 4.6.7 and Appendix Figure 4.6.3). Most other fields increased in their average levels of teaching experience over time, particularly technology, agriculture, business and marketing, and home economics.

7. Experience in Industry

Not surprisingly, vocational education teachers are much more likely to have experience working in industry than nonvocational education instructors. About 23% of vocational education teachers had such experience in 1988, compared with about 11% of nonvocational education teachers (see Table 4.7.1). About 20% of vocational education teachers had such experience in 1994, compared with about 11% of nonvocational education teachers. The proportion of vocational education teachers with experience in industry declined somewhat over the six-year period, suggesting that recruitment from industry has lessened.

Table 4.7.1. Proportion of Teachers with Industry Experience of Teachers, Vocational Versus Nonvocational Education Teachers, Nationwide, by Year

Year	*Vocational*	*Nonvocational*	*Difference*
1988	0.23	0.11	0.12
1991	0.21	0.10	0.11
1994	0.20	0.11	0.09

Source: Schools and Staffing Survey

The difference in industry experience between vocational education teachers in comprehensive high schools and those in vocational schools is marked: less than 20% compared with over 50% in 1994 (see Table 4.7.2). The amount of experience in industry declined noticeably for comprehensive high school vocational education teachers over the six-year period.

Table 4.7.2. Proportion of Teachers with Industry Experience, Vocational Education Teachers in Comprehensive High Schools Versus Those in Vocational Schools, Nationwide, by Year

Year	*Comprehensive*	*Vocational*	*Difference*
1988	0.20	0.53	-0.33
1991	0.18	0.56	-0.39
1994	0.17	0.56	-0.39

Source: Schools and Staffing Survey

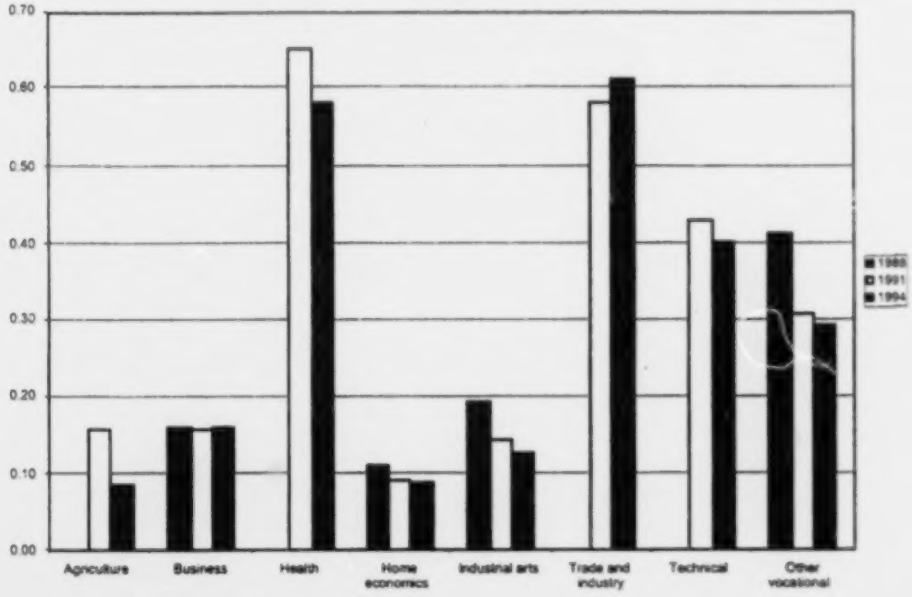
The proportion of teachers with industry experience varies widely across vocational fields (see Table 4.7.3 and Figure 4.7.1). The fields characterized by the most outside experience in industry are health, trade and industry, and technical. The teachers least likely to have had outside experience are those in agriculture and home economics.

Table 4.7.3. Proportion of Vocational Education Teachers with Industry Experience, by Vocational Subfield

Year	*Agriculture*	*Business*	*Health*	*Home Economics*	*Industrial Arts*	*Trade and Industry*	*Technical*	*Other Vocational*
1988	—	0.16	—	0.11	0.20	—	—	0.41
1991	0.16	0.16	0.65	0.09	0.14	0.58	0.43	0.31
1994	0.09	0.16	0.58	0.09	0.13	0.61	0.40	0.29

Source: Schools and Staffing Survey
Note: Some vocational education subfields were not specified in the 1987-1988 SASS. Blank entries represent subfields not surveyed.

Figure 4.7.1. Proportion of Teachers with Industry Experience in Each Vocational Education Subfield, Nationwide, by Year



Source: Schools and Staffing Survey

Wages and Certification

8. Real salary

Conceptually, salaries are indicators of the outcome of the interaction of supply and demand in a competitive market. In the labor market for teachers, they may reflect these forces as well as the influence of institutions, such as unions. One must be careful in interpreting the meaning of changes in salaries, but they do provide potential useful information about the state of the labor market for vocational education teachers.

Since teacher salaries are based upon years of experience and qualifications, differences in mean salaries across different groups of teachers reflect (1) variation in mean experience and educational levels, (2) differences in the cost of living and relative employment of teachers, and (3) actual differences in districts' willingness or ability to offer higher salaries.

Nationally, vocational education teachers' real base salaries did not differ significantly from the real salaries of academic teachers (see Table 4.8.1).[15]

[15] Salary values for all datasets are deflated by the Consumer Price Index with the base year set to 1998, in order to increase the relevance and comparability of statistics over time.

Salaries for both types of teachers were higher in 1991 than in 1988 and 1994. The salaries of vocational education teachers in vocational schools were significantly lower than those of their counterparts in comprehensive high schools in 1991 and 1994 (see Table 4.8.2).

Table 4.8.1. Mean Real Salary, Vocational Versus Nonvocational Education Teachers, Nationwide, by Year

Year	*Vocational*	*Nonvocational*	*Difference*	*p > |t|*
1988	37,313	37,056	258	0.237
	(196)	(96)		
1991	38,607	38,690	-84	0.771
	(257)	(131)		
1994	38,584	38,294	289	0.393
	(314)	(128)		

Source: Schools and Staffing Survey
Note: Standard errors are in parentheses.

Table 4.8.2. Mean Real Salary[1] of Vocational Education Teachers, Comprehensive High Schools Versus Vocational Schools, Nationwide, by Year

Year	*Comprehensive*	*Vocational*	*Difference*	*p > |t|*
1988	37,336	37,126	210	0.675
	(213)[2]	(452)		
1991	38,722	37,511	1,211	0.018
	(279)	(431)		
1994	38,683	37,376	1,307	0.048
	(336)	(568)		

[1] Salaries are deflated by the Consumer Price Index and reported in 1998 dollars.
[2] Standard errors are reported in parentheses.
Source: Schools and Staffing Survey

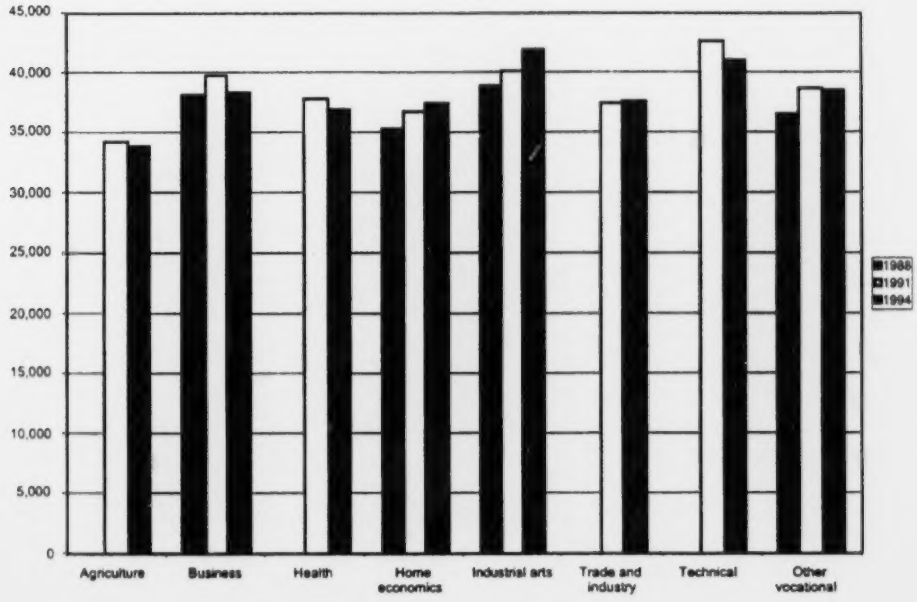
Mean real base salary varied somewhat according to vocational education subfield, although the variation never exceeded $9,000. At the national level, industrial arts and technical fields had the highest average salary, while agriculture had the lowest (Table 4.8.3 and Figure 4.8.1).

Table 4.8.3. Mean Real Salary of Teachers in Each Vocational Education Subfield, Nationwide, by Year

	Agriculture	*Business*	*Health*	*Home Economics*	*Industrial Arts*	*Trade and Industry*	*Technical*	*Other Vocational*
1988		38,116		35,362	38,933			36,564
1991	34,255	39,677	37,762	36,731	40,122	37,491	42,532	38,669
1994	33,914	38,340	36,885	37,512	41,943	37,692	40,952	38,450

Source: Schools and Staffing Survey
Note: Some vocational education subfields were not specified in the 1987-1988 SASS. Blank entries represent subfields not surveyed.

Figure 4.8.1. Mean Real Salary of Teachers in Each Vocational Education Subfield, Nationwide, by Year



Source: Schools and Staffing Survey

In Texas, vocational education teachers were paid significantly more than nonvocational education teachers throughout the period of study (see Appendix 4.8.4). Note, however, that the salaries have tended slightly towards convergence over time. Vocational education teacher salaries were at their peak in 1988, after which they tended to decline until 1996, with a slight upturn in 1993.

In Texas, teachers' salaries remained more homogeneous across vocational education subfields than the national picture suggested. Agriculture teacher salaries appear somewhat higher than the average teacher salary in the state, whereas health and business are at the bottom of the list (see Appendix 4.8.5 and Appendix Figure 4.8.2).

In New York, vocational education teachers were paid significantly more than nonvocational education teachers throughout the period of study (see Appendix 4.8.6). Unlike in Texas, the salary differential has tended to increase over time. New York teachers in both categories experienced a sharp salary increase between 1988 and 1998.

In New York, teachers' salaries remained fairly homogeneous across vocational education subfields and exhibited notable growth between 1980 and 1998 (see Appendix 4.8.7 and Appendix Figure 4.8.3). Health teachers had the lowest average salary during the latter part of the period. Given the difference in the variation patterns present in the New York, Texas, and national data, it seems reasonable to suggest that teacher salary may vary not only across fields but from state to state within a given field.

9. Barriers to Entry

In order to obtain a sense of the range of variation in state certification requirements, we looked at how many states required bachelor's degrees for vocational education teachers and how many allowed the substitution of work experience for the degree. In addition, since trade and industry teachers were often the sole category of vocational education teachers that was exempted from a bachelor's degree requirement, we also looked at the number of states that required a bachelor's degree for all vocational education teachers except those in trade and industry. This information was quantified for the entire U.S. and by region and for the years 1988 and 1998. We were thus able to get a sense of whether or not certification became more or less difficult during the ten-year period. The results are presented in Table 4.9.1. Although not all states are represented, it appears that educational barriers to entry lessened over the ten-year period. The percentage of states requiring a bachelor's degree for a vocational education teaching certificate declined from 40 to 24%. Looser educational requirements regarding trade and industry teachers were also apparent at the end of the period. These findings suggest that during this period the educational system moved to facilitate the entry of vocational education teachers coming from industry.

Table 4.9.1. Changes in the Requirements for Vocational Education Certification 1988-1998, Nationwide

Part A. 1988

Region	*Percentage that Require BA for All Voc-Ed Teachers*	*Percentage that Require BA Except for T & I*	*Percentage that Can Substitute Work for BA*
Northeast[1]	20.0%	0.0%	20.0%
West[2]	37.5%	0.0%	12.5%
South[3]	20.0%	20.0%	10.0%
Midwest	83.3%	16.7%	0.0%
Totals	40.2%	9.2%	10.6%

[1] No data for MA, NH, VT
[2] No data for HI, ID, OR, UT, WA
[3] No data for GA, LA, NC, SC, WV, OK
[4] No data for IN, KS, MN, MO, ND

Part B. 1998

Region	*Percentage that Require BA for All Voc-Ed Teachers*	*Percentage that Require BA Except for T & I*	*Percentage that Can Substitute Work for BA*
Northeast[1]	11.1%	25.0%	25.0%
West[2]	12.5%	0.0%	25.0%
South[3]	13.3%	20.0%	75.0%
Midwest	58.3%	16.7%	16.7%
Totals	23.8%	20.5%	35.4%

[1] No data for MA
[2] No data for WY, AZ, and the data are unclear for CO
[3] No data for SC
Source: National Association of State Directors of Teacher Education and Certification

Data from the state of New York regarding certification are displayed in Appendix 4.9.2 and Appendix Figure 4.9.1. The percentage of vocational education teachers who were noncertified grew between 1985 and 1990 and again between 1995 and 1998, suggesting that certification, itself, became less of a barrier to entry during those periods.

Indicators of Demand

10. Enrollments

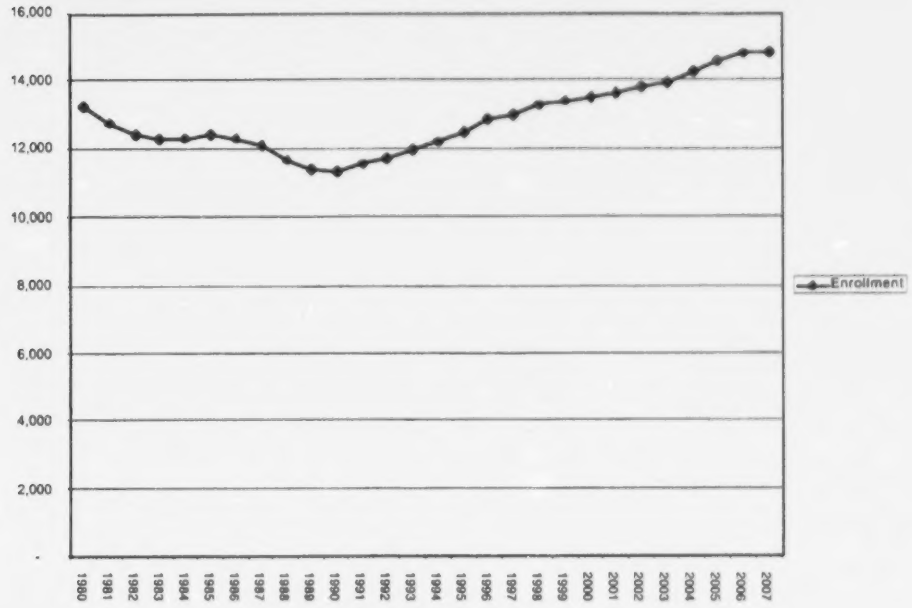
Trends in the number of students enrolled in public secondary schools provide useful baseline measures to be incorporated into an assessment of trends in the demand for vocational education. Public secondary enrollments declined slightly in the early 1980s and again in the late 1980s, but since 1990, they have risen steadily and are expected to increase every year through the year 2008, according to projections furnished by the National Center for Education Statistics (see Table 4.10.1). Figure 4.10.1 displays these trends graphically.

Table 4.10.1. Past and Projected Public Secondary School Enrollments (in Thousands)

Year	*Enrollment*	*Year*	*Enrollment*
1980	13,231	1994	12,213
1981	12,764	1995	12,500
1982	12,405	1996	12,834
1983	12,271	1997	13,003
1984	12,304	1998	13,270
1985	12,388	1999	13,420
1986	12,333	2000	13,537
1987	12,076	2001	13,643
1988	11,687	2002	13,800
1989	11,390	2003	13,951
1990	11,338	2004	14,263
1991	11,541	2005	14,579
1992	11,735	2006	14,785
1993	11,961	2007	14,854
		2008	14,746

Source: U.S. Department of Education (1997), Table 3

Figure 4.10.1. Past and Projected Public Secondary School Enrollment



Source: U.S. Department of Education (1998b)

Although the enrollment trends of various regions and demographic groups have not been predicted by the NCES, we used information published by the U.S. Bureau of the Census to obtain a sense of the direction of trends in geographic and racial subgroups. Table 4.10.2 indicates that the regions defined as the South and the West will experience the largest increases in population between the years 1995 and 2025. It also indicates that an increase in the Hispanic population that is double the size of an increase in any other racial group is to be expected between 1995 and 2025. The increase will occur to a disproportionately greater extent in the region defined as the West.

Table 4.10.2. Population Change of U.S. and Regions, by Race: 1995-2025

Region	*Total*	*White*	*Black*	*Native American*	*Asian*	*Hispanic Origin*
U.S.	72,295	15,594	11,920	812	11,970	31,999
Northeast	5,927	-2,074	1,495	32	2,319	4,155
Midwest	7,306	1,825	1,857	194	1,132	2,298
South	29,558	10,407	7,642	199	1,792	9,518
West	29,504	5,436	926	387	6,727	16,028

Source: U.S. Bureau of the Census, Population Division, Preferred Series, PPL-47, Table 3

11. Pupil-Teacher Ratios

Nationally, average pupil-teacher ratios are significantly lower for vocational education classes than for nonvocational education classes: 20 versus 24 in 1988 and 19 versus 24 in 1994 (see Table 4.11.1). Pupil-teacher ratios for both types of classes declined between 1988 and 1991 but rose again in 1994 though not to their 1988 levels. Vocational class sizes increased more than nonvocational class sizes in the latter part of the period.

Table 4.11.1. Pupil-Teacher Ratios

Year	*Vocational Ratio*	*Nonvocational Ratio*	*Difference*	*p > |t|*
1988	19.80	24.24	-4.44	0
1991	18.13	23.01	-4.88	0
1994	19.29	23.94	-4.66	0

Source: Schools and Staffing Survey

Mean pupil-teacher ratios varied somewhat across vocational education subfields. In 1994, trade and industry classes were the smallest, with about 17 pupils per teacher, and business, health, industrial arts, and technical classes were largest, with about 20 pupils per teacher (Table 4.11.2).

Table 4.11.2. Mean Pupil-Teacher Ratios in Vocational Education Subfields, Nationwide

Year	*Agriculture*	*Business*	*Health*	*Home Economics*	*Industrial Arts*	*Trade and Industry*	*Technical*	*Other Vocational*
1988	—	21.44	—	20.17	19.01	—	—	17.98
1991	16.32	18.89	19.77	18.33	17.66	15.86	18.16	18.98
1994	17.64	19.84	20.00	19.31	20.16	16.95	19.74	18.61

Source: Schools and Staffing Survey
Note: Some vocational education subfields were not specified in the 1987-1988 SASS. Blank entries represent subfields not surveyed.

Our New York dataset also provides us with pupil-teacher ratios for both vocational and nonvocational education teachers. As to be expected given the national picture, vocational education teachers in New York taught significantly smaller classes than nonvocational education teachers (see Table 4.11.3). They also experienced a decline in class size between 1980 and 1990 but an increase between 1990 and 1998. Nonvocational education teachers experienced the same pattern of decline and increase. These trends are consistent with the enrollment trends described in the prior section. Enrollments declined between 1980 and 1990, and then began to grow. It is likely that pupil-teacher ratios fluctuated in the manner described because the teaching workforce did not downsize immediately in response to a declining student population or increase in response to a rising one.

Table 4.11.3. Mean Number of Pupils Per Teacher for Vocational and Nonvocational Education Teachers

	Vocational	*Nonvocational*	*Difference*
1980	21.13 (11.82)	28.73 (32.27)	-7.60
1985	19.47 (8.70)	26.56 (31.69)	-7.09
1990	18.91 (11.79)	28.68 (49.76)	-9.77
1995	20.11 (13.76)	29.77 (50.16)	-9.66
1998	21.91 (16.51)	27.67 (27.25)	-5.76

Source: Schools and Staffing Survey
Note: Standard errors are in parentheses.

12. Course-Taking Patterns

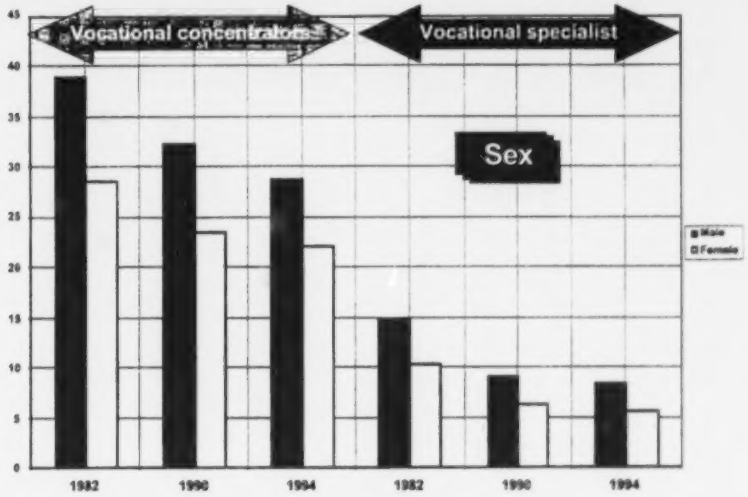
Studies of trends in student course taking in the 1980s and 1990s indicate that the percentage of students participating in some form of vocational education held fairly steady, but that a smaller percentage of students concentrated in vocational education as a program of studies and the average number of vocational education courses per student declined. Over the decade between 1982 and 1992, academic course taking on the part of high school students increased, largely as a result of the push to raise academic standards that ensued after the publication *of A Nation at Risk* in 1983. The effect on vocational education course taking was largely negative.

Trends in Participation in Vocational Education Programs

Trends in the 1980s and 1990s indicate that, although participation in some form of vocational education remained nearly universal on the part of high school students, fewer and fewer students concentrated in vocational education as a program of studies. The percentage of high school graduates taking at least one vocational education course decreased only very slightly from 98.2% in 1982 to 97.2% in 1994; however, the percentage of public high school graduates concentrating (accumulating three or more credits) in vocational education programs declined from 33.7% in 1982 to 25.4% in 1994, and the percentage of public high school graduates specializing (accumulating four or more credits with two or more credits beyond the introductory level) in vocational education programs declined from 12.6% in 1982 to just 7% in 1994 (U.S. Department of Education, 1999).

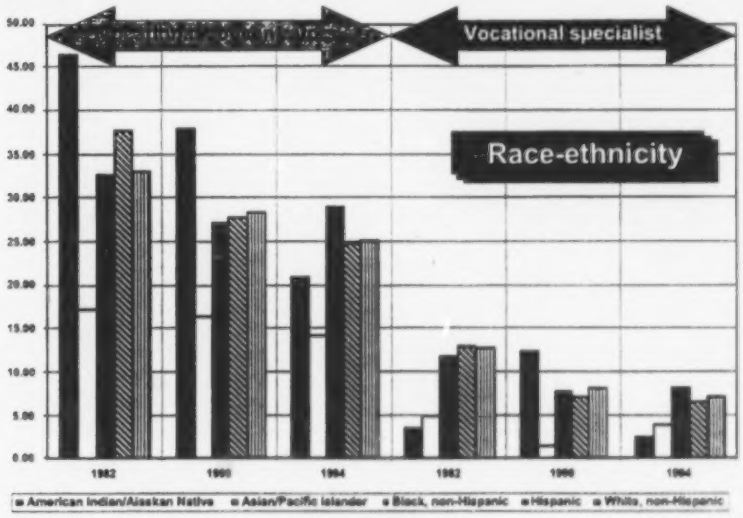
Figure 4.12.1 displays graphically how patterns of concentration and specialization differed by particular subgroups. Part A shows that a decline was evident for both males and females. Part B shows that Hispanics experienced a 12.8 percentage point drop in concentration and a 6.7 percentage point drop in specialization. Since Hispanics made up 9.9% of the total public elementary and secondary school population in 1986 and 13.5% of the same total in 1995, it appears that the decline in Hispanic participation may have been an important factor driving the overall decline in vocational education.

Figure 4.12.1. Part A – Percentage of Public High School Graduates Concentrating (Accumulating 3 or More Credits) and Specializing (Accumulating 4 or More Credits with 2 or More of Those Credits Beyond the Introductory Level) in Vocational Programs, by Sex and Year: 1982, 1990, and 1994



Source: U.S. Department of Education (1999)

Part B – Percentage of Public High School Graduates Concentrating (Accumulating 3 or More Credits) and Specializing (Accumulating 4 or More Credits with 2 or More of Those Credits Beyond the Introductory Level) in Vocational Programs, by Race-Ethnicity: 1982, 1990, and 1994



Source: U.S. Department of Education (1999)

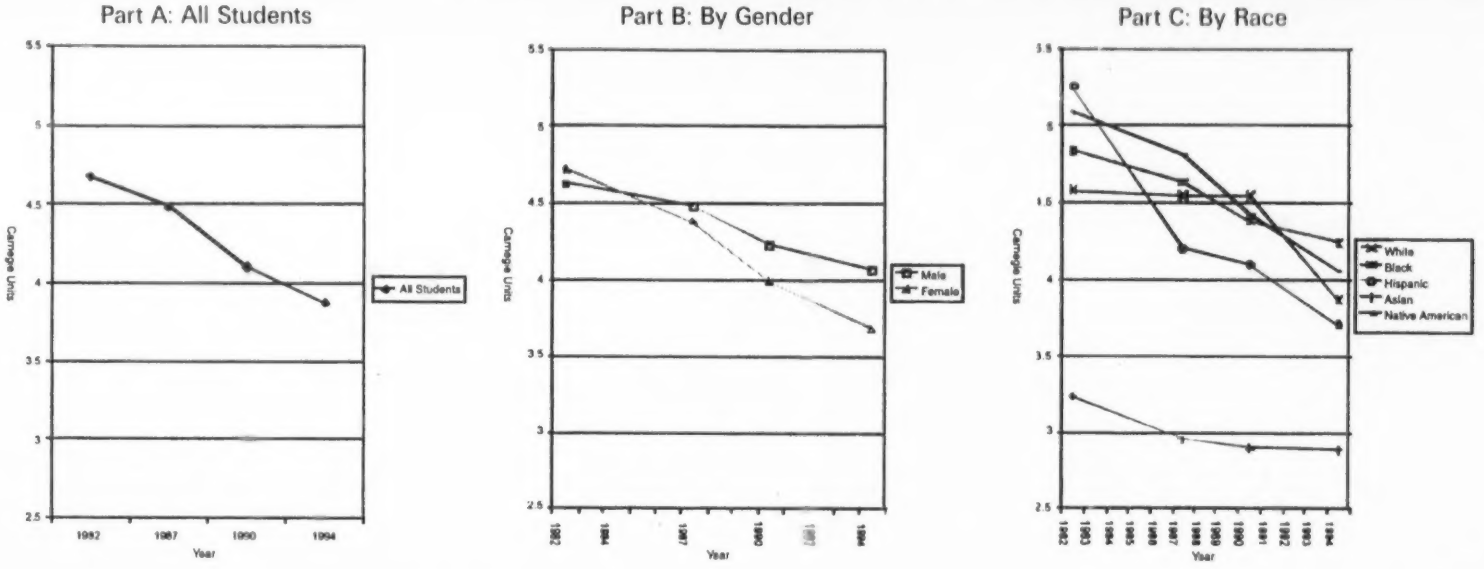
Trends in the Numbers of Vocational Education Courses Taken

Over this same period, the number of vocational education course units taken by the average high school student has declined. Research reported by the National Center for Education Statistics shows that the average number of Carnegie Units taken by public secondary students has decreased from 4.68 in 1982 to 3.87 in 1994 (see Figure 4.12.2 Part A). Since total public secondary enrollments were 12,405,000 in 1982 and 12,213,000 in 1994, the overall number of vocationally related Carnegie Units earned by public high school students decreased from 58,055,400 to 47,264,310 units, a difference of 10,791,090 units. This is a very large drop in just over a decade.

There have been some changes in the demographic composition of students in vocational education. Female students have decreased their vocational education course taking more than male students (Figure 4.12.2 Part B), and Hispanic students have decreased their vocational education course taking more than students in other racial groups (Figure 4.12.2 Part C).

The *Digest of Educational Statistics* divides the vocational curriculum into three groups: (1) general labor market preparation, (2) consumer and homemaking, and (3) specific labor market preparation. Courses in general labor market preparation are designed to provide students with skills that are applicable to a wide range of job-related activities such as typing, business English, or career exploration (see Burns, 1996). The consumer and homemaking curriculum consists of courses imparting skills that are generally used outside the paid labor force such as home economics and child development. Specific labor market preparation consists of courses in the following subfields: agriculture, business, marketing, health, occupational home economics, trade and industry, and technical and communications.

Figure 4.12.2. Average Number of Carnegie Units Taken by Public School Graduates in Vocational Courses 1982-1994



Source: U.S. Department of Education (1999)

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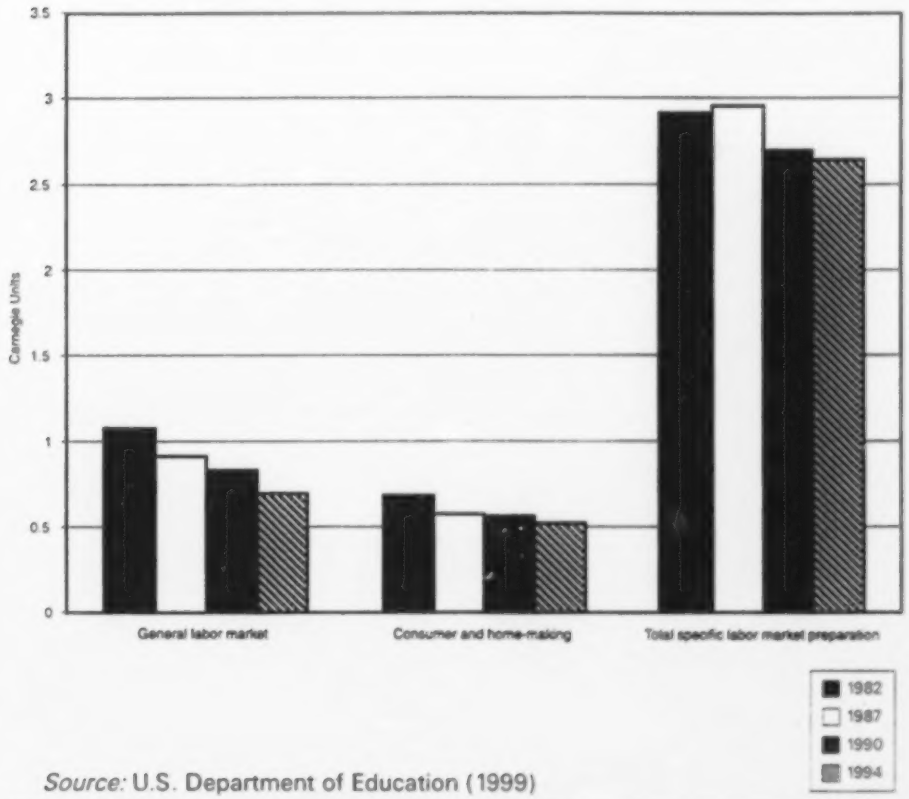
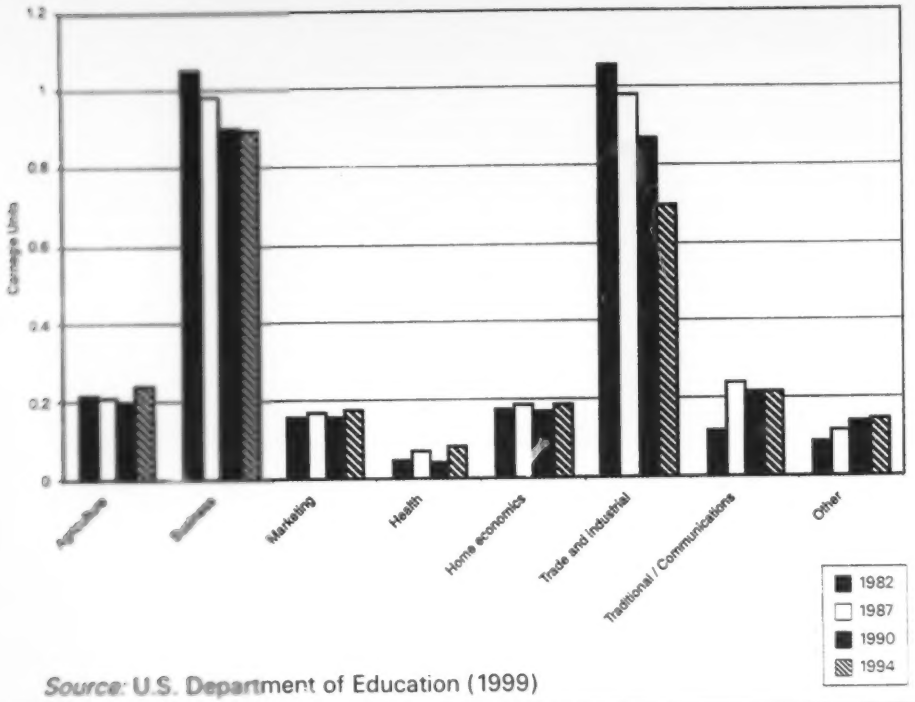
The largest component is that of specific labor market preparation. Figure 4.12.3 shows that all three areas experienced a decline between 1982 and 1994, although the specific labor market preparation group experienced a short-lived increase between 1982 and 1987. Figure 4.12.4 displays trends in the various subcategories that compose specific labor market preparation. The decline in course taking designed as specific labor market preparation was localized in two areas: (1) business and (2) trade and industry. In both fields, the decline has been generated by a decrease in male participation (see Figures 4.12.5 and 4.12.6). In trade and industry, however, ethnic differences in the rates of decline are also evident. Hispanics and Native Americans show the steepest rate of decline.

Figure 4.12.3. Vocational Preparation by Year



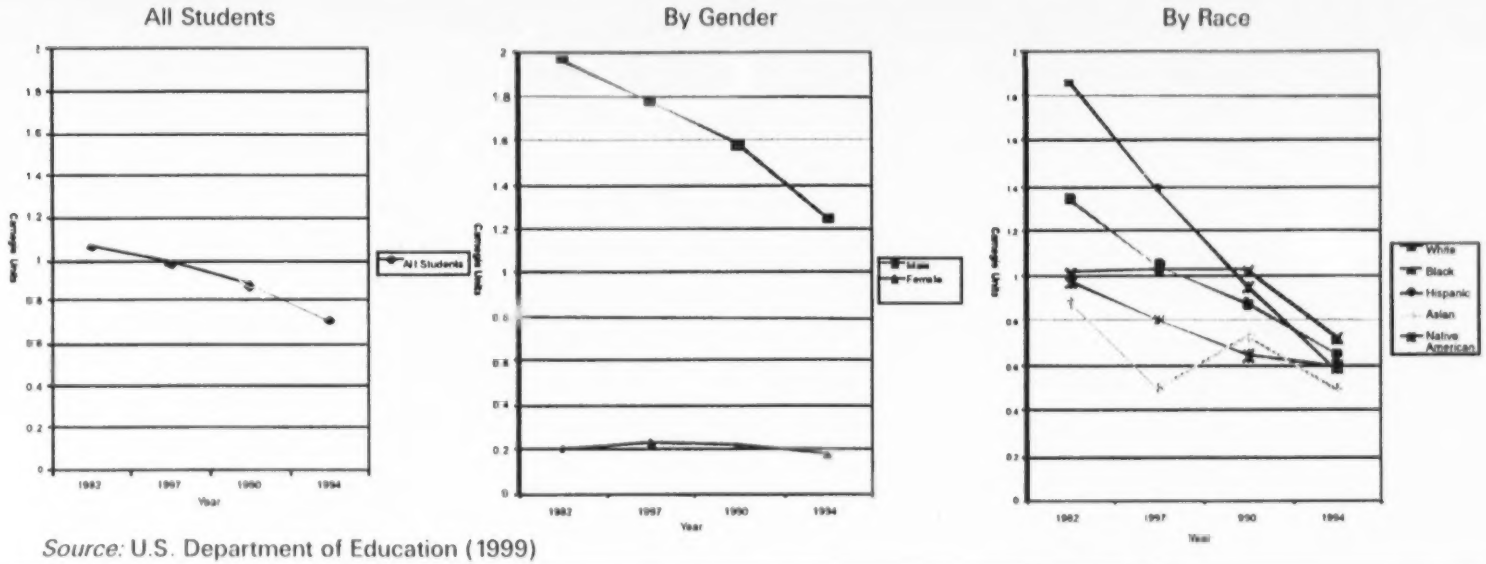
Source: U.S. Department of Education (1999)

Figure 4.12.4. Specific Vocational Preparation by Year



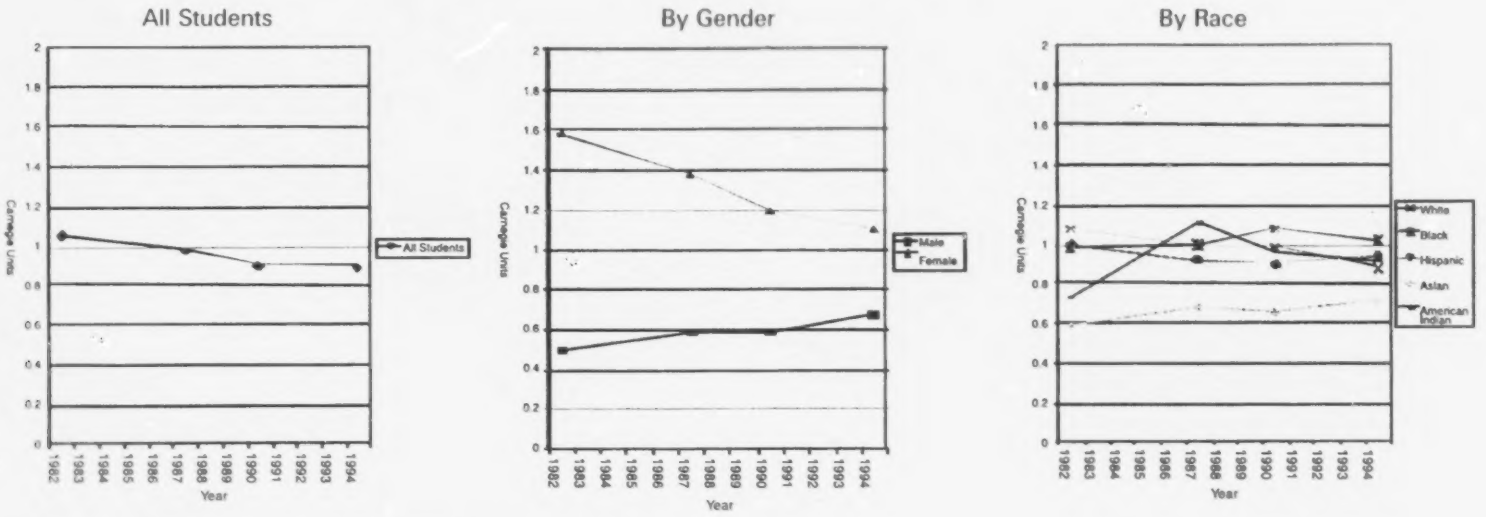
Source: U.S. Department of Education (1999)

Figure 4.12.5. Average Number of Carnegie Units Taken by Public School Graduates in Vocational Courses 1982-1994, Specific Preparation in Trade and Industry



Source: U.S. Department of Education (1999)

Figure 4.12.6. Average Number of Carnegie Units Taken by Public School Graduates in Vocational Courses 1982-1994, Specific Preparation in Business



Source: U.S. Department of Education (1999)

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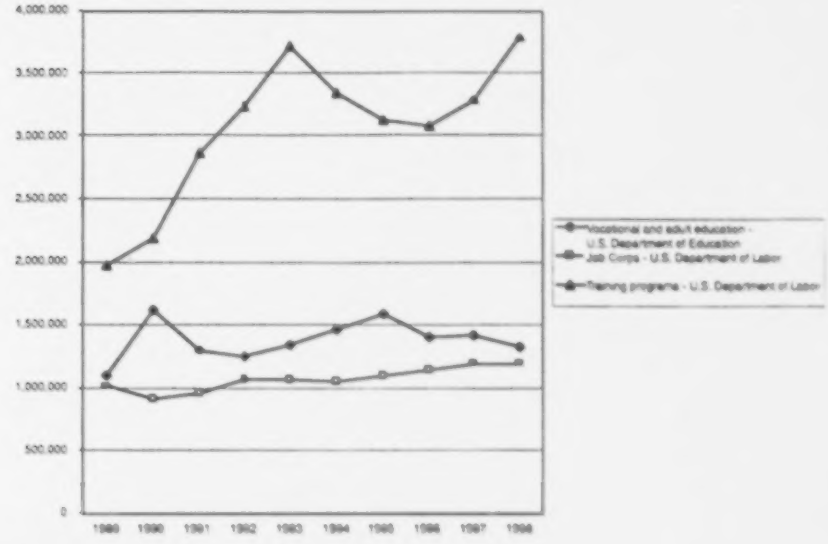
In summary, over the period 1982 through 1994, the U.S. experienced a decline in vocational education course taking, which may or may not have translated into a weakening of the demand for vocational education teachers. Trade and industry was the field of study experiencing the greatest decline. Hispanic course taking, which was originally at a higher level than that of other races, declined to below the level of most other races. These appear to have been the most important contributing factors. Since Hispanics make up a higher proportion of the overall population in the West and Southwest than in other regions, it is possible that the decline in vocational instruction decreased more heavily in these regions than in others.

13. Funding

Little systematic information is available on trends in the funding of vocational education from local and state sources despite the fact that these sources provide the majority of funding for vocational education. Information can be obtained, however, regarding federal funds, although these provide a relatively small source of support for vocational education. The Digest of Education Statistics reports on federal funds devoted to secondary vocational programs over time. Figure 4.13.1 displays these trends. The numbers reported are in thousands of dollars, and the dollars are deflated to 1998 levels using the Consumer Price Index. While the U.S. Department of Labor has increased its funding of training programs, the funding of vocational education by the U.S. Department of Education has declined since 1995.

Figure 4.13.1. Trends in Real Federal Funding of Vocational Education Programs



Source: U.S. Department of Education (1998a), Table 361

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Indicators of Supply

14. New Entrants

Table 4.14.1 shows the proportion of vocational and nonvocational education teachers who are new entrants to teaching in each year. In the period of downsizing that occurred in the late 1980s as a result of enrollment declines, the proportion of new entrants declined for both vocational and nonvocational education teaching. The decline was from 8% to 7% between 1988 and 1991 for vocational education teachers and from 11% to 9% for nonvocational education teachers. As enrollments began to increase in the early 1990s, however, the proportion of new entrants to vocational teaching did not experience a corresponding increase but instead a further decline to 6%. The percentage of newly entering nonvocational education teachers held steady at 9%.

Table 4.14.1. Proportion of New Teachers, Vocational Versus Nonvocational Education Teachers

Year	*Proportion of Vocational Education Teachers*	*Proportion of Nonvocational Education Teachers*	*Difference*
1988	0.08	0.11	-0.02
1991	0.07	0.09	-0.03
1994	0.06	0.09	-0.03

Source: Schools and Staffing Survey

The initial decline in the percentage of newly entering vocational education teachers between 1988 and 1991 was more pronounced in vocational schools than in comprehensive schools (see Table 4.14.2). In vocational schools, the percentage dropped from 12% to 9%, whereas in comprehensive schools the percentage dropped form 8% to 6%. The percentage of new entrants to comprehensive schools remained at 6% in 1994 but dropped to 5% in vocational schools, suggesting that these schools were either less desirable or less available to new entrants during this time period.

Table 4.14.2. Proportion of New Teachers, Comprehensive High School Vocational Education Teachers Versus Vocational School Teachers

Year	*Proportion of Comprehensive High School Vocational Education Teachers*	*Proportion of Vocational School Teachers*	*Difference*
1988	0.08	0.12	-0.04
1991	0.06	0.09	-0.03
1994	0.06	0.05	0.01

Source: Schools and Staffing Survey

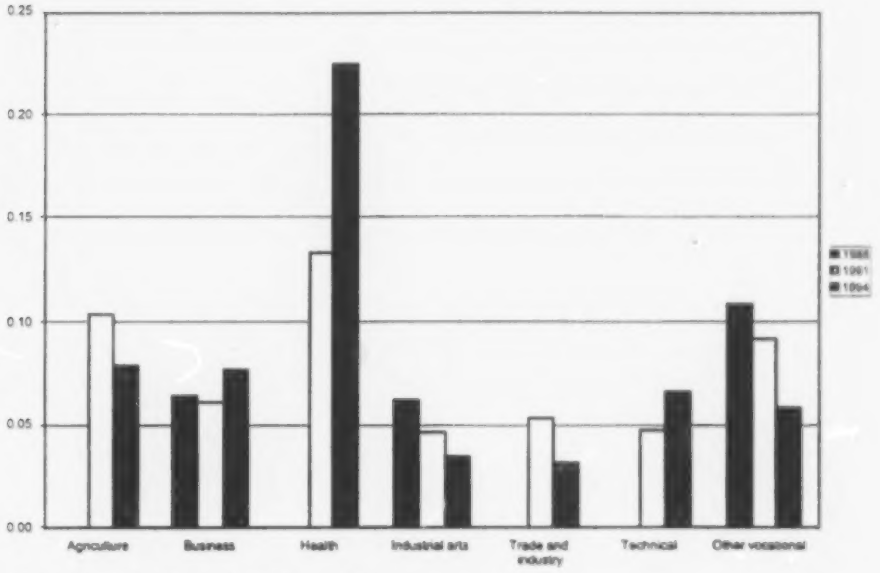
Within the vocational education subfields, only health, business, and technology showed an increase in the percentage of new entrants during the time period spanned by the national dataset, with the largest increase occurring for health (see Table 4.14.3 and Figure 4.14.1). All other fields showed declines ranging from two to five percentage points. These findings suggest that, at the national level, traditional vocational education fields, such as home economics, industrial arts, and trade and industry were hiring fewer new teachers, either because these teachers were not available or because the demand for them had declined.

Table 4.14.3. Mean Pupil-Teacher Ratios in Vocational Education Subfields, Nationwide

	Agriculture	*Business*	*Health*	*Industrial Arts*	*Trade and Industry*	*Technical*	*Other Vocational*
1988		0.06		0.06			0.11
1991	0.10	0.06	0.13	0.05	0.05	0.05	0.09
1994	0.08	0.08	0.23	0.04	0.03	0.07	0.06

Source: Schools and Staffing Survey
Note: Some vocational education subfields were not specified in the 1987-1988 SASS. Blank entries represent subfields not surveyed.

Figure 4.14.1. Proportion of New Teachers in Each Vocational Education Subfield, Nationwide, by Year

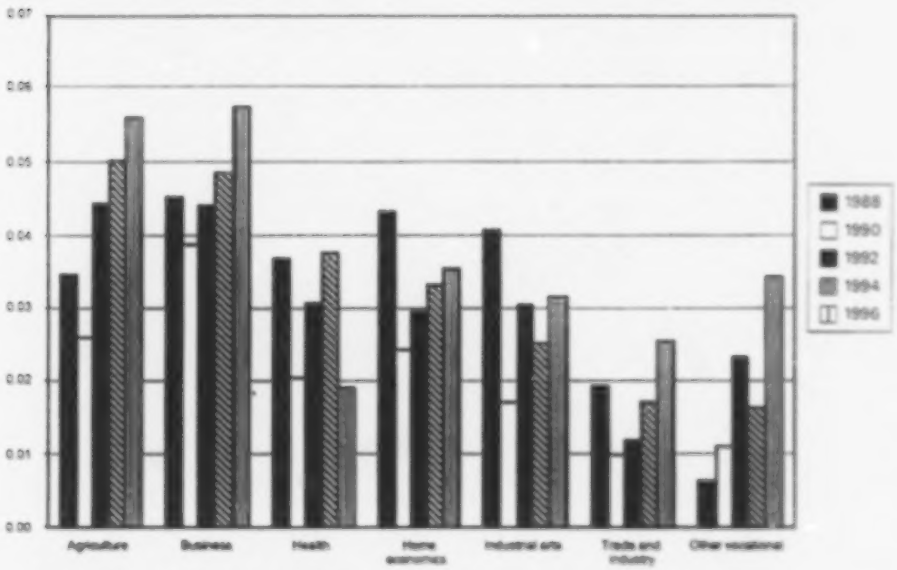


Source: Schools and Staffing Survey

In Texas, the proportion of new entrants to vocational teaching was lower in all years for vocational education teachers versus nonvocational education teachers (see Table 4.14.4). The proportion of new entrants to vocational teaching declined to some degree with enrollment trends in the late 1980s, but both vocational and nonvocational education teachers experienced an increase in 1991 and again in 1996, suggesting that enrollment fluctuations did not exert a differential impact on the two types of teaching.

With regard to vocational education subfields in Texas, we find that agriculture, business, home economics, and trade and industry experienced a slight upswing in the proportion of new entrants between 1995 and 1996, whereas health and industrial arts experienced a downswing (see Table 4.14.5 and Figure 4.14.2). Throughout the period spanning from 1988 to 1996, we see a range in the percentage of new entrants in various vocational education subfields of between zero and 6%, whereas the same percentage in the national sample ranged from three to 23% for the years spanning from 1988 to 1994.

Figure 4.14.2. Proportion of New Teachers in Each Vocational Education Subfield, in Texas, by Year



Source: Texas Education Agency

Table 4.14.4. Proportion of New Teachers, Vocational Versus Nonvocational, in Texas, by Year

Year	*Vocational*	*Nonvocational*	*Difference*
1988	0.03	0.05	-0.02
1989	0.02	0.05	-0.03
1990	0.02	0.05	-0.03
1991	0.03	0.06	-0.03
1992	0.03	0.06	-0.04
1993	0.03	0.06	-0.03
1994	0.03	0.06	-0.03
1995	0.03	0.06	-0.03
1996	0.04	0.07	-0.03

Source: Texas Education Agency

Table 4.14.5. Proportion of New Teachers in Each Vocational Education Subfield, in Texas, by Year

Year	*Agriculture*	*Business*	*Health*	*Home Economics*	*Industrial Arts*	*Trade and Industry*	*Other Vocational*
1988	0.03	0.05	0.04	0.04	0.04	0.02	0.01
1989	0.03	0.03	0.01	0.03	0.02	0.01	0.00
1990	0.03	0.04	0.02	0.02	0.02	0.01	0.01
1991	0.04	0.06	0.03	0.03	0.02	0.01	0.02
1992	0.04	0.04	0.03	0.03	0.03	0.01	0.02
1993	0.05	0.05	0.02	0.04	0.02	0.01	0.02
1994	0.05	0.05	0.04	0.03	0.03	0.02	0.02
1995	0.04	0.04	0.04	0.03	0.04	0.02	0.03
1996	0.06	0.06	0.02	0.04	0.03	0.03	0.03

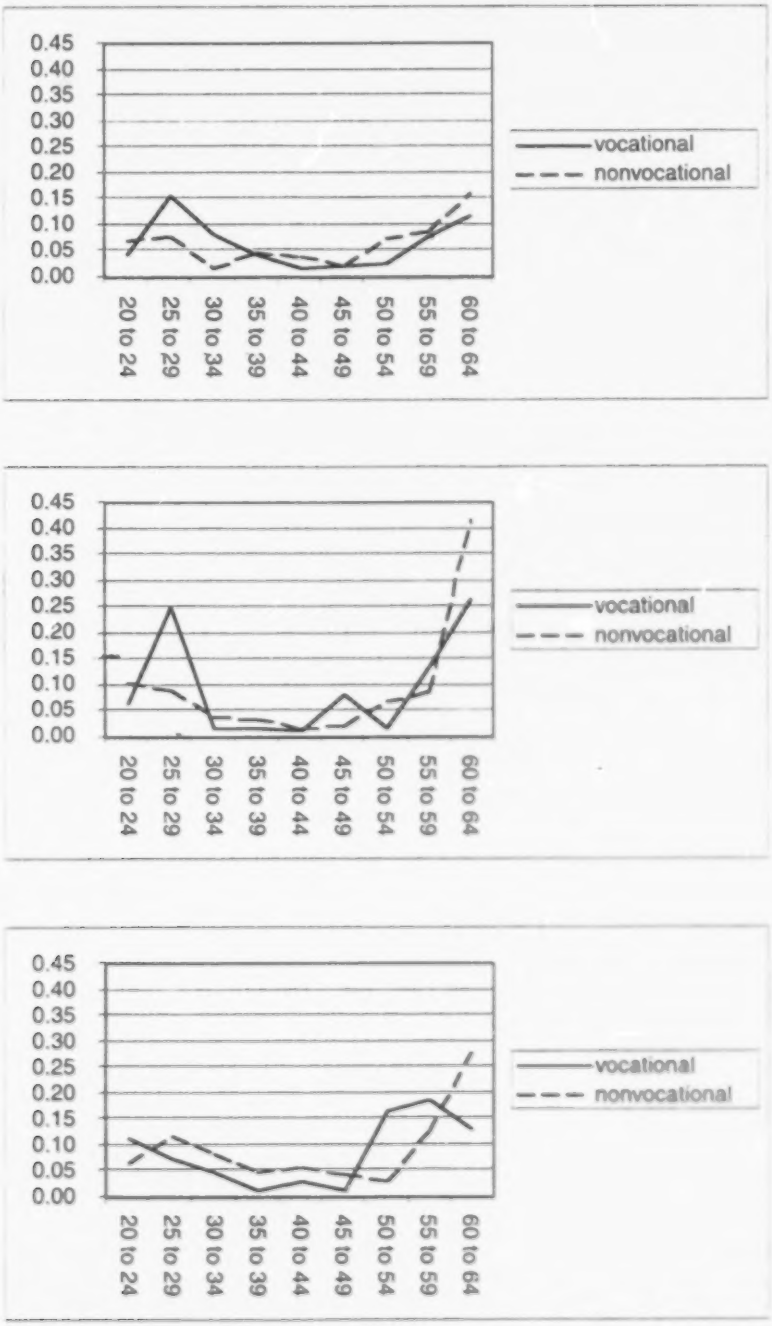
Note: Some vocational education subfields were not specified in the 1987-1988 SASS. Blank entries represent subfields not surveyed.

15. Attrition

To explore patterns of attrition using the SASS, we first plotted the percentage of each age group that left teaching in each year of the sample (see Figure 4.15.1). The 1988 graph showed a quit rate that was slightly higher for vocational education teachers than nonvocational education teachers at an early age but delayed with respect to retirement. As time passed, however, vocational education teachers were less likely to quit at an early age and more likely to retire at a younger age nationwide.

Figure 4.15.2 plots attrition patterns for experience groups rather than age groups. The U-shaped attrition-by-experience pattern is more pronounced for vocational education teachers than for nonvocational education teachers. The U-shaped pattern for vocational education teachers and the distinction between vocational and nonvocational education teachers becomes more pronounced with time.

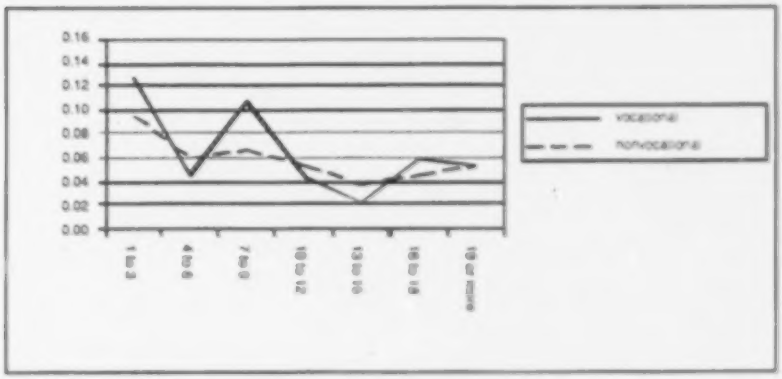
Figure 4.15.1. Attrition of Teachers by Age Group



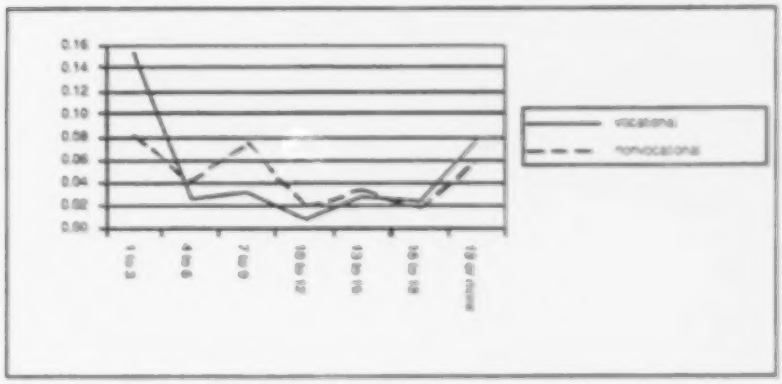
Source: Schools and Staffing Survey

Figure 4.15.2. Attrition of Teachers by Experience Group, Nationwide

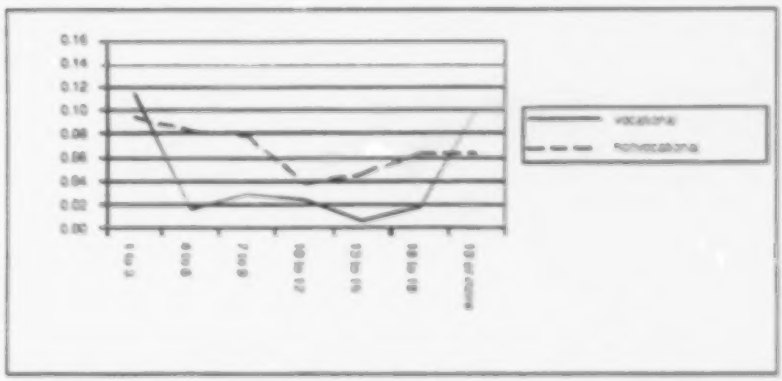
1988



1991



1994



Source: Schools and Staffing Survey

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The longitudinal dataset from Texas shows similar trends to those at the national level for attrition by age group. Appendix Figure 4.15.3 shows that vocational education teachers in 1988 exhibited higher attrition rates at each age level than nonvocational education teachers, but that over time, the differences tended to lessen. Appendix Figure 4.15.4 shows that vocational education teachers in Texas exhibited a more pronounced U-shaped pattern with respect to attrition by experience group, but that, in contrast to the national picture, the distinction between vocational and nonvocational education teachers lessened over time.

Direct Indicators of Shortage or Surplus

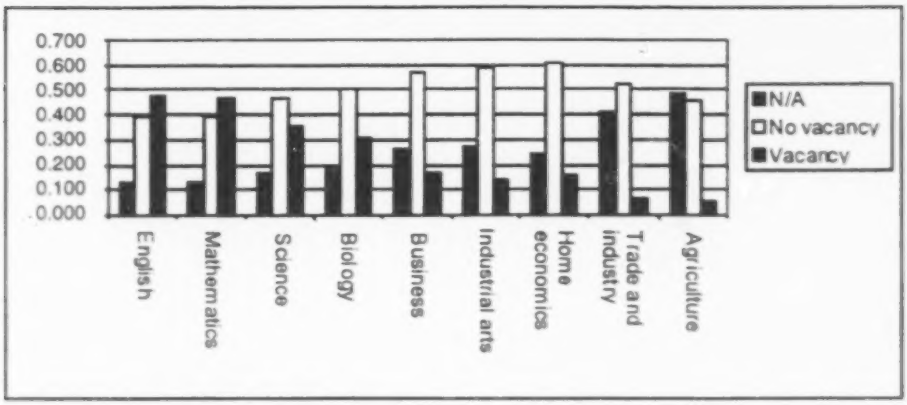
16. Vacancies

The 1993-1994 Schools and Staffing Survey school questionnaire asked schools to report on the difficulty of filling vacancies for teaching positions in various fields. For each field, respondents reported whether any vacancies in the field occurred and whether they found these vacancies "easy," "difficult," "very difficult," or impossible to fill. These responses are highly subjective, and caution is required in utilizing them as indicators of shortages. They do, however, give us an indication of the existence and persistence of vacancies.

Figure 4.16.1 shows the extent to which schools reported vacancies in several fields, both academic and vocational. The academic fields represented are English, math, science, and biology. The vocational education fields represented are business, industrial arts, home economics, trade and industry, and agriculture. Many schools gave a response of "not applicable" when the particular fields did not exist at the school. Of those schools for which the question was applicable, fewer reported vacancies in vocational education fields than in academic fields.

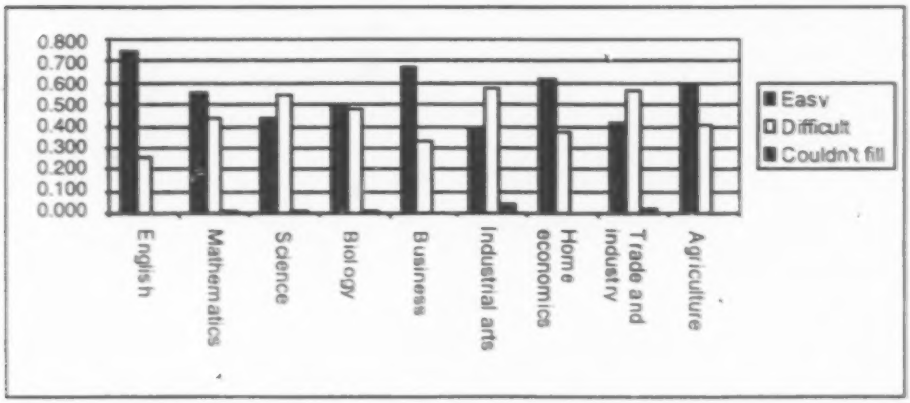
Among schools reporting vacancies, industrial arts and trade and industry were the two vocational education fields that were the most difficult to fill (Figure 4.16.2). Figures 4.16.3 through 4.16.7 indicate that schools in rural areas had the greatest difficulty filling vocational education vacancies.

Figure 4.16.1. Proportion of Vacant Positions in Various Fields in 1993



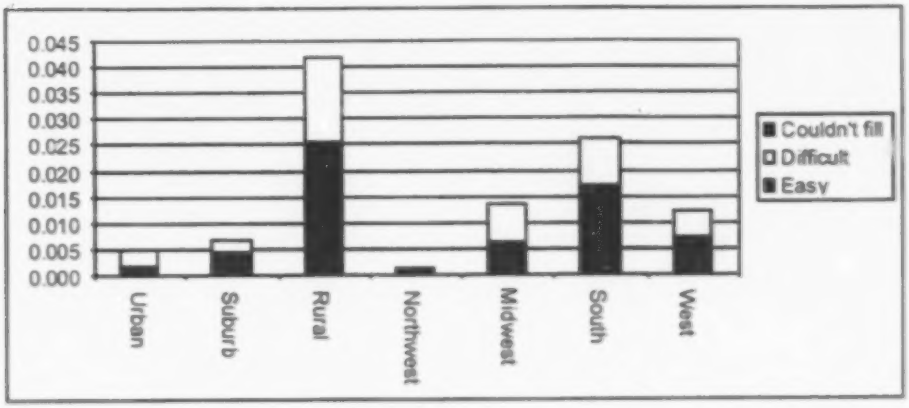
Source: Schools and Staffing Survey

Figure 4.16.2. Difficulty Filling Vacancies, Expressed as a Proportion of Schools with Vacancies



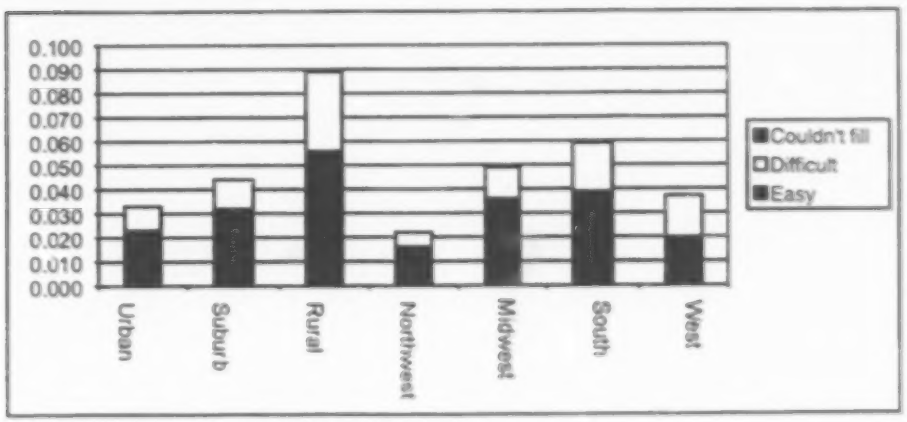
Source: Schools and Staffing Survey

Figure 4.16.3. Difficulty Filling Agriculture Vacancies by Urbanicity and Region, as a Proportion of All Schools



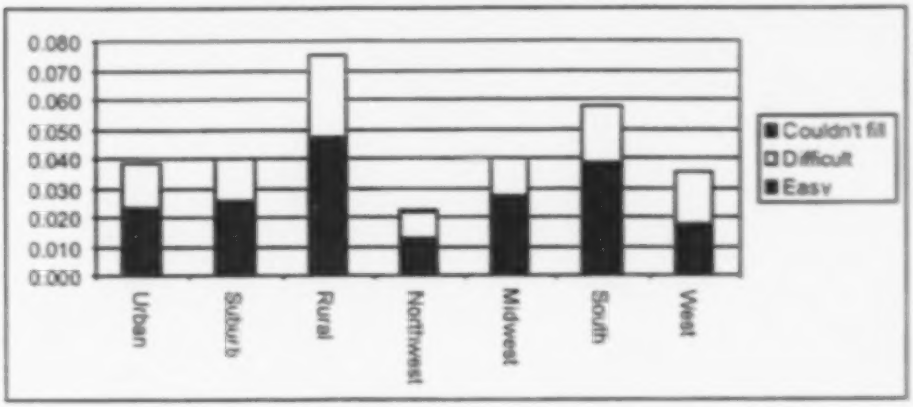
Source: Schools and Staffing Survey

Figure 4.16.4. Difficulty Filling Business Vacancies by Urbanicity and Region, as a Proportion of All Schools



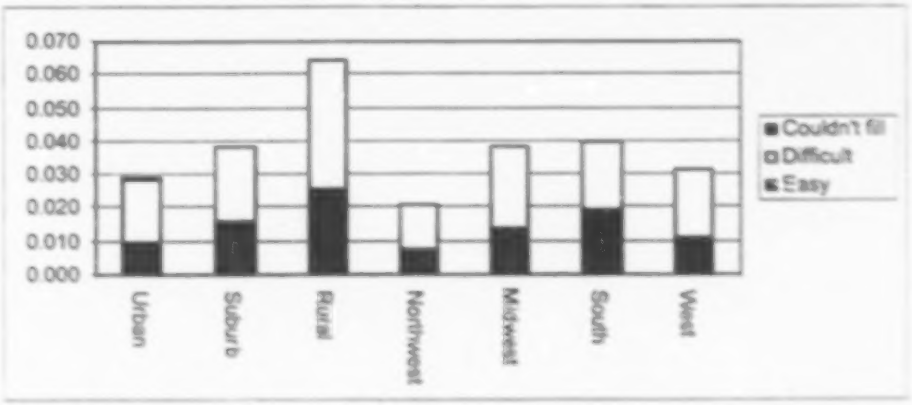
Source: Schools and Staffing Survey

Figure 4.16.5. Difficulty Filling Home Economics Vacancies by Urbanicity and Region, as a Proportion of All Schools



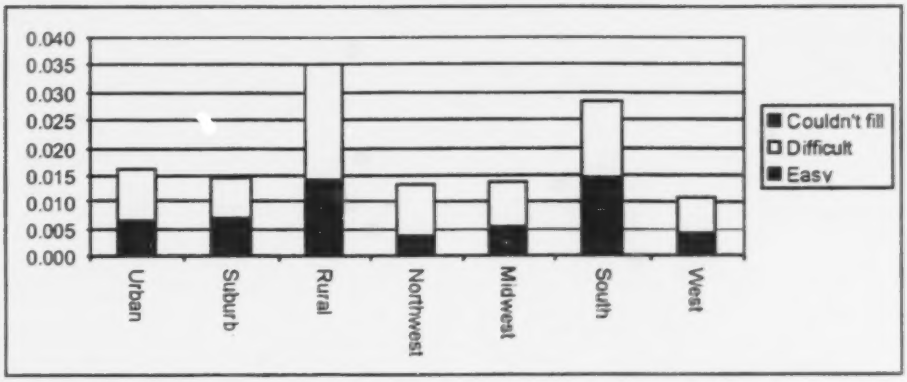
Source: Schools and Staffing Survey

Figure 4.16.6. Difficulty Filling Industrial Arts Vacancies by Urbanicity and Region, as a Proportion of All Schools



Source: Schools and Staffing Survey

Figure 4.16.7. Difficulty Filling Trade and Industry Vacancies by Urbanicity and Region, as a Proportion of All Schools



Source: Schools and Staffing Survey

CHAPTER V

The Labor Market for Secondary Vocational Education Teachers—Shortage or Surplus? A Summary of Findings and Suggestions for Future Policy Research

Media reports abound of looming shortages in the teacher labor market. Based on enrollment projections alone, it appears that—assuming pupil-teacher ratios do not change much—we will need considerably more teachers to staff the nation's classrooms in the years to come. Although we know that historically enrollment drives the demand for teachers, it does not translate smoothly into demand, since schools and districts are able to adjust pupil-teacher ratios, subject to facilities and other resource constraints, rather than hire more teachers. Since models of district behavior that would explain and predict decisions regarding staffing do not exist, most forecasters simply assume that the relationship between enrollment and staffing continues to exhibit its current trend.

Whether an increase in enrollment-driven demand will translate into a shortage of teachers is unknown. That requires understanding the supply side of the teacher labor market as well as the demand side. Yet very little reliable information about the supply side of the labor market is available—in part because the underlying decisions of individuals as to whether to teach are very complex. These decisions involve the weighing of an almost infinite number of alternative labor market opportunities and uses of time. Although we can gain a crude idea of the number of new graduates emerging from schools of education and the likelihood with which they have entered teaching in the past, these decisions are likely to be sensitive to the overall state of the economy. We have only the flimsiest notion of how large the "reserve pool" of individuals who would be willing and able to teach—all potential teachers that schools can draw upon when needed—really is. Sizing this pool is very difficult since there are almost no data that would enable such a calculation. Many previously predicted shortages have failed to materialize because of the ability of schools and districts to draw upon this group. The capacity of schools to find sufficient individuals to fill classrooms should not be underestimated. A good illustration of this is provided by the recent case of California's implementation of class size reduction in the early grades which saw an

increase in the number of K-3 teachers hired by 35% in just two years. Most school districts acted to fill new slots rapidly by drawing teachers from other grades and districts, from outside of teaching, and from neighboring states. Of course, the hiring boom has not occurred "all else constant" in that many of the new hires do not have full permanent state certification (Reichardt & Brewer, 1999). Although the link between teacher certification and teacher quality is far from established empirically, the dramatic change in the numbers of credentialed teachers points to a labor market response. A shortage or a surplus reflects a given level of quality or a given salary level—either or both of which may adjust in the case of a large shortage or surplus.

Part of the motivation for this study was the concern voiced by some vocational educator groups about possible shortages in the labor market for certain kinds of secondary vocational education teachers. Reports from school districts of problems in finding suitable individuals to fill some positions, of the attrition of teachers in some fields in the context of a booming economy, and of strong ongoing outside labor markets in fields such as health, have given rise to concerns in national organizations of administrators and teachers about vocational education shortages. Unfortunately, *a review of the existing data as we have undertaken in this report cannot pinpoint shortages or surplus in a particular field in a particular geographic location at a particular point in time*—which is the kind of information that the field would find most useful. The difficulty of reaching concrete conclusions about the state of the vocational education teacher labor market is compounded by a number of factors, including a decline in vocational education course taking against a background of growing enrollment, the higher likelihood that vocational education teachers come from or can go into occupations other than teaching, and the paucity of research on the behavior of vocational education teachers as opposed to academic teachers.

Our conceptual overview in Chapter II suggested some of the key components of supply and demand about which one would need to have good information to make reliable, detailed statements about future supply and demand. For example, one of the factors underlying the demand for vocational education teachers is the demand for vocational education course taking. Although we can observe in national data a decline in the overall volume of vocational education, we cannot be sure that it will continue. Ideally, we would have a model of individuals' decisions to select certain courses and of school, district, and state administrators' decisions to offer such programs. This is not an impossible task, but existing data are wholly inadequate to the task and there has been very little research on the behavioral determinants of these important decisions.

The main indicators that one would need for a full accounting of the demand for vocational education teachers include the following:

- Enrollments
- Pupil-teacher ratios by field
- Course taking and course offering by field and type of student
- Funding sources
- Labor market prices

All these data must be collected at the micro—that is, school or district—level. In addition, an understanding is needed of the underlying decision models guiding district, student, community, industry, and state preferences for vocational education.

The main indicators that one would need for a full accounting of the supply of vocational education teachers include the following:

- The numbers and characteristics of teachers who enter the teaching profession
- The numbers and characteristics of teachers who leave teaching for unemployment
- The numbers and characteristics of teachers who transfer to and from other teaching labor markets
- The numbers and characteristics of teachers who transfer to and from industry
- The numbers and characteristics of teachers who change their time commitment from full-time to part-time and vice versa
- The numbers and characteristics of teachers who return to teaching after a hiatus

These data are needed at the labor market level, and, in each case, an understanding is needed of the underlying decision models guiding these choices.

The integration of these factors leads to the identification of the following measures indicating shortage conditions:

- Increases in real salaries
- Increases in pupil-teacher ratios
- Decreases in quality
- Decreases in barriers to entry
- Persistent vacancies

Data on very few of these indicators are available in a detailed, consistent manner that would permit annual accounting of the state of vocational education teacher labor markets. For example, information on course-taking patterns is spotty; enrollment projections are highly aggregated; there is no annual collection of data on the number and type of students entering and completing vocational education teacher preparation programs; and so on.

Similarly, indirect indicators of shortage or surplus—such as vacancy data—are not collected systematically. Even when they are gathered periodically, such as in the Schools and Staffing Survey, the questions are too vague and subjective to permit inferences with any reliability about the state of the labor market in particular subfields.

A summary of information that we were able to collect follows in the next section.

Summary of Results

Despite the shortcomings of existing data sources, our review of the existing literature on the labor market for vocational education teachers, combined with interviews with stakeholders and analyses of available state and national data, produces a great deal of information about who is currently teaching vocational education in public secondary schools and produces a template for future data collection at the local and state levels of analysis. It also informs a discussion of trends in future demand and supply. Before we draw some conclusions about the state of the labor market and what specific data sources might allow us to paint a more informative picture, we summarize the main findings discussed in the previous chapter:

- The size of the vocational education teaching force and its size relative to the total teaching force appears to have declined since the early 1980s. We find evidence of this decline using data at the national level between 1988 and 1994, data from New York between 1980 and 1998, and data from Texas between 1988 and 1996.
- Vocational education teachers tended to be evenly split between men and women, but a great deal of occupational segregation existed across subfields. The movement towards desegregation over time was very slight.
- Racial differences between vocational and nonvocational education teachers were not apparent. The technical, trade and industry, industrial arts, and agriculture fields had the lowest percentage of nonwhite teachers.
- Vocational education teachers were significantly older on average than nonvocational education teachers, and their average age increased over time. Vocational education teachers in vocational schools were older than those in comprehensive high schools. Agriculture teachers tended to be youngest. Health, trade and industry, and technical teachers tended to be the oldest, with the latter two groups showing a faster rate of age growth over time. The significance of a higher and growing average age is difficult to determine. It could be that fewer openings were being offered due to a lowered demand, that fewer openings were being filled due to a decrease in supply, or that openings were progressively being filled by older people.

- Vocational education teachers had lower levels of educational attainment than nonvocational education teachers, due primarily to the fact that training programs for many vocational education fields, such as health and trade and industry, are completed at the associate degree level. Vocational education teachers without bachelor's degrees, however, tended to be concentrated in vocational high schools. Vocational education teachers in comprehensive high schools tended to have similar degree profiles to nonvocational education teachers.
- Vocational education teachers had slightly more teaching experience than nonvocational education teachers in each year of the sample, about one and a half years more in 1994. This may be due to smaller proportions of new teachers in this population or to the greater teaching longevity of vocational education teachers. Since the average age differential was about two years, the experience gap could be attributed largely to age. The experience differential grew over time, as the average experience level grew more steeply for vocational education teachers than for nonvocational education teachers.
- Vocational education teachers were more likely to have had industry experience than other teachers, as one would expect given the work-oriented nature of their teaching assignments and the fact that work experience is often permitted as substitute for education in the vocational teaching certification process. The fields with the most teachers with outside experience were health, trade and industry, and technical.
- Real salaries of vocational education teachers were higher in 1991 than in 1988 and 1994. The same pattern occurred for nonvocational education teachers. Perhaps average salaries declined in accordance with declining enrollments but with a lag of about two years. The salaries of vocational education teachers in vocational schools were significantly higher in 1991 and 1994 than those of the same types of teachers in comprehensive schools. These teachers were older and tended to have more industry experience, but they had less public school teaching experience and lower educational credentials. In general, average salaries tended to be higher for older groups of teachers.
- Educational barriers to entry contained in the certification process for vocational education teachers were lowered between 1988 and 1998. Our findings suggest that the educational system moved to facilitate the entry of vocational education teachers coming from industry during this time period.
- Public secondary enrollments declined between 1980 and 1990 and then began to rise at a fairly constant rate. They are projected to rise through the year 2007, and the greatest increases will occur within the Hispanic population.
- In accordance with enrollment trends, pupil-teacher ratios declined between 1988 and 1991 and then rose by 1994. They did not rise to their 1988 levels, however, despite the fact that enrollments were higher in 1994 than in 1988. A slight lag in the response to enrollments seems to

have been operating as the teaching labor market adjusted. Although pupil-teachers ratios for vocational education teachers were significantly lower than they were for nonvocational education teachers, they rose and fell in the same proportion.

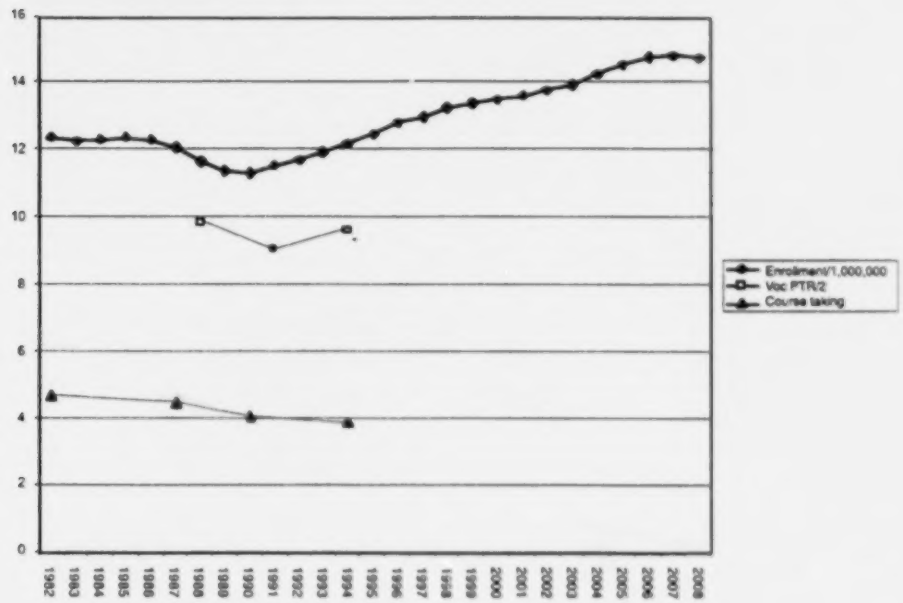
- In the period between 1982 and 1994, there was a notable decline in vocational course taking, due, by many accounts, to a slackening in the demand for this type of instruction and an overall trend towards a more academic high school curriculum. Trade and industry was the field experiencing the greatest decline. Hispanics, who had traditionally been the group with the highest enrollment in vocational education, shifted their course-taking patterns dramatically to become less involved in vocational education than most other groups by the end of the period.
- Federal funding of vocational education from the U.S. Department of Education showed a decline in real dollars since the beginning of 1995. The U.S. Department of Labor, however, has increased its funding of training programs at the secondary level and has maintained steady funding of its Job Corps program.
- The proportion of new entrants—that is, teachers without prior teaching experience—declined for both the vocational and nonvocational education groups between 1988 and 1991. The proportion of new entrants to vocational teaching was lower than that to nonvocational teaching in both years, however. For the former group, the decline continued through 1994, whereas for the latter group, it leveled off. Vocational schools showed the greatest decline in this proportion, suggesting that these schools were either less desirable or less available to new entrants during this time period. With respect to vocational education subfields, only health, business, and technology showed an increase in the percentage of new entrants, with the largest increase occurring in health.
- Attrition rates for both vocational and nonvocational education teachers were found to be higher at early and late ages. We, therefore, replicated the expected U-shaped attrition-by-age pattern found in prior research. In 1988, vocational education teachers appeared more likely to quit at an early age than nonvocational education teachers, but they tended to retire at older ages. By 1994, this pattern had nearly reversed. A plot of attrition by experience level also produced a U-shaped pattern. The U-shaped attrition-by-experience pattern for vocational education teachers and the distinction between vocational and nonvocational education teachers became more pronounced over time.
- Fewer schools reported vacancies in vocational education fields than in academic fields, but this is not surprising due to the greater proportion of academic teachers in almost all types of high schools except vocational schools. Among schools reporting vacancies, industrial arts and trade and industry were the two vocational fields that were the most difficult to fill. Schools in rural areas appeared to have had the greatest difficulty filling vocational education vacancies.

Adding It All Up

What are we to make of these trends? We have a national picture in which public secondary enrollments are expected to continue to grow over time, yet we know that the nation experienced a decline in vocational education course taking between 1982 and 1994. Hispanics were the racial group experiencing the greatest decline in vocational education course taking, and this is the racial group expected to grow at the fastest rate in the next two decades.

Figure 5.1 plots vocational education course-taking trends on the same graph with trends in public secondary enrollments and vocational education pupil-teacher ratios. Enrollments were divided by 1,000,000 and pupil-teacher ratios were divided by two in order to plot these trends alongside course-taking trends. The course-taking trend shown is that shown previously in Figure 4.12.2: that is, the average number of Carnegie Units taken in vocational education instruction by public high school students. The graph indicates that while pupil-teacher ratios followed trends in enrollment almost exactly, vocational education course taking did not rise in the post-1990 period of enrollment growth.

Figure 5.1. A Comparison of Trends in Public Secondary Enrollments, Vocational Education Pupil-Teacher Ratios, and Vocational Education Course-Taking Patterns



Sources: U.S. Department of Education (1998b), Table 1; Schools and Staffing Survey; U.S. Department of Education (1999)

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Taking these trends together, it is very difficult to project the future for vocational education. If one assumes that pupil-teacher ratios will remain constant, then the fact that enrollment and course taking are moving in opposite directions would lead one to suspect that, on net, neither a strong decline nor an increase in the demand for vocational education teachers is likely. But this conclusion is at best tentative for several reasons.

First, although we can be fairly certain that enrollments will rise, course taking is an imperfect indicator of student demand for vocational education, since it reflects students' tastes conditioned upon the existence of course offerings and graduation requirements. There is almost no research on the underlying behavioral determinants of students' choices. Will a recession affect the courses students take? Will changes in the rate of return to a college education translate into changes in the high school programs students choose? Is the observed decline in course taking among Hispanics likely to continue or will the trend level off—an especially important question for the future of vocational education in light of the changing demographics of the student population? Furthermore, course taking is highly influenced by policy variables such as state requirements for academic high school graduation standards and college entrance requirements—both a function of a volatile policy environment.

Second, as noted in the introduction to this report, vocational education is changing—the boundaries between academic and vocational education have increasingly been broken down, purposively so. Policymakers, to some extent backed by research, have attempted to give academically inclined students some occupational knowledge, and more markedly have tried to beef up the academic standards of those in vocational education programs. Existing data collection efforts have not "caught up" with this changing reality—teachers continue to be classified along traditional lines, for example, even though they might teach a range of courses with an occupational emphasis. These changes may well be one of the drivers of anecdotal localized reports of open slots that districts cannot fill. It may be that the difficulty is in finding teachers that are able to teach modern occupational education, but this is a matter of speculation.

On the supply side of the labor market, the facts are perhaps even sparser. We know that teachers are aging and likely to retire in large numbers—this pattern applies as much or more so to vocational education teachers as to the profession as a whole. As we have also seen, attrition in the first few years of teaching, when the likelihood of quitting is already high, is if anything higher for vocational education teachers than for nonvocational education teachers; however, there is almost no research on the underlying drivers of attrition and retirement behavior for vocational education teachers. One would guess that alternative labor market opportunities are particularly important in determining the behavior of some subfields of

vocational education. In recent years, external opportunities may have grown rapidly, making it less likely that individuals would enter teaching.

In our conceptual framework, we theorized that a particular set of trends could signal a shortage in the vocational education teacher labor market: rising salaries, rising pupil-teacher ratios, decreases in teacher quality, and decreases in barriers to entry into the teaching profession. Opposite trends could indicate a surplus. Our analysis of these trends has given us mixed results.

Our investigation of trends in barriers to entry over time has shown that educational requirements for vocational education teachers became more liberal between 1988 and 1998. This would seem to indicate that educational policy makers moved to facilitate the entry of potential vocational education teachers, possibly in response to a shortage. We lack, however, corresponding information on industry experience requirements, and we are unable to assess whether the loosening of educational requirements occurred in response to perceived shortages or in response to changes in philosophy as to the types of qualifications that signal the adequacy of vocational education teachers.

We have used education as a proxy for teacher quality. Our findings show that although the average educational level of vocational education teachers is lower than that of nonvocational education teachers, it seems to be rising over time. These trends in education would seem to argue against the presence of shortage conditions. It is important to note, however, that in the overall economy, the pursuit of education has increased, thus trends in vocational education teacher education are not unique.

Experience, in this case, is an unsatisfactory indicator of quality. The rising experience level of vocational education teachers appears to go hand in hand with the rising average age level and the decline in the proportion of new entrants. These trends could characterize markets in both shortage and surplus conditions. Newer teachers may be unavailable for hire due to a shortage, or newer teachers may not be sought after as the result of a surplus.

Pupil-teacher ratios, as we have seen, have tended to follow enrollment trends, suggesting that staffing is slow to respond to these fluctuations. This may be the case either because the supply of teachers does not immediately increase as demand increases or because districts are conservative in their staffing responses to these trends, perhaps viewing enrollment upswings as a means to divert new funds from staffing to other instructional needs. Third, the extent to which school district and teacher unions will allow pupil-teacher ratios to adjust as demand and supply fluctuate is uncertain. If resources for vocational education are not increasing, there are unlikely to be resources to sustain shrinking class sizes in the face of decreases in demand. Unfortunately, data on trends in the funding of vocational education are entirely lacking at the local and state levels.

Movements in wages are a central indicator of movements in demand or supply in free markets, but the teacher labor market is characterized by a notable amount of institutionally motivated wage rigidity. Furthermore, although a teacher's total compensation consists of more than her or his wage, very little information exists about benefits, bonuses, and working conditions. What we do know is that real salaries of both vocational and nonvocational education teachers have increased over time, but this phenomenon must be viewed within the context of an aging teaching force, a highly controlled salary scale, and an economy in which the salary of the average college-educated worker has increased dramatically over the course of the past two decades. Even in the context of a market with a large pool of qualified teachers, it is possible, under these conditions in the wider labor market, to see some increase in salaries simply in order to attract and retain enough qualified teachers to fulfill staffing needs.

Given the complexity of the labor market for vocational education teachers, it is difficult to make clear predictions of impending shortages or surpluses. In our general assessment of vocational education teaching, we find no unambiguous indicators of either condition. In addition, although we find evidence that some variation exists due to region and vocational education subfield, we do not have the data to pinpoint the specifics of this variation.

Lessons for Future Policy and Future Research

Given the aggregate nature of our data, we have been unable in this report to answer the question of whether there is a shortage or a surplus in the vocational education teacher labor market. More precise appraisals of trends would involve studies of each vocational education subfield separately at the labor market level. Such studies would involve the examination of data on the characteristics of teachers, entry and exit into the profession, the wages of teachers and the relevant alternatives to teaching, and course offering patterns and course-taking patterns distinguished from one another. Behavioral models explaining the preferences of districts, students, and other relevant entities need to be developed on the demand side. Similar models explaining the preferences of potential teachers are in need of further development on the supply side.

In the process of examining available information from extant sources, however, we have made a number of contributions:

- The conceptual building blocks for an indicator system of supply and demand have been outlined.
- The lack of research on key parts of the determinants of the demand and supply of vocational education teachers, such as student course taking, the decision of individuals to enter the teaching profession, and the decisions of districts to hire vocational education teachers, have been highlighted.

- The inadequate nature of current data collection efforts in their periodicity, comparability, and level of detail on teacher labor market indicators, have been pointed out.

These points lead to a key question: How can data collection efforts be improved?

A prelude to answering this question is to consider what utility there is in knowing whether there is a shortage or surplus in a specific subfield of teaching at a particular point in time. In other words, suppose we had uncovered a shortage in the secondary vocational education teacher labor market, what would be the policy implications? In principle, publicity surrounding such a finding could induce the key stakeholders in the education system to act—state policymakers, for example, could act to further reduce certification requirements which prevent individuals from entering teaching, state or federal officials could develop new programs or funding streams to boost the enrollment in vocational education teacher education programs, and so on. But even if the needed information were available, the leverage points may be weak. Decisions are made by individuals and by schools and school districts in a highly decentralized manner. Without strong incentives—for example, higher salaries for subfields with a shortage—the market is likely to respond slowly. Furthermore, intervening in the labor market is potentially problematic when the market clearly responds with a lag. There is a possibility that "corrective" action would overcompensate for a shortage such that the market would be characterized by alternating "boom" and "bust" cycles, as pointed out by Freeman (1976). Having said this, reliable ongoing information on the labor market for teachers could be extremely useful to monitor and explain trends and to avert potential movement towards shortage in a productive and preemptive manner.

Should new data be collected at the state or federal levels? National data collection such as the Schools and Staffing Surveys are large, expensive undertakings. SASS, for example, in order to get representative samples of teachers in every state, involves gathering survey information from more than 40,000 individuals. It is impractical to do this on an annual basis. From a sampling design perspective, one is unlikely to be able to generate sufficient samples to generalize about agriculture teachers in the northeast, or trade and industry teachers in Florida. This suggests that although improvements could certainly be made in the SASS, and the federal government might consider more regular kinds of "snapshot" studies to provide useful information, it is state administrative data that holds the most promise.

Some states already collect detailed information on individual teachers and their assignments. These can be improved by adding more detailed information on teachers' education and experience. In addition, states collect data from schools and districts on an annual basis, and it would be relatively

straightforward to add additional items on vacancies, turnover, hiring plans, difficulties of filling slots, recruitment activities, and so on, by subfield. It would be feasible to obtain a series of annual measures of the state of the labor market from school districts.

Aside from the lack of this supplementary information, two major omissions characterize statewide data collection efforts. The first consists of data on the movements of teachers. Within the educational system itself, it should be possible to identify teachers and schools and to track teachers' movements in and out of specific districts. This is only part of the information needed to complete the picture, however. It is also necessary to track the movements of teachers in and out of the educational system. If state educational data collection agencies would collaborate with state employment and unemployment insurance agencies, it would then be possible to build longitudinal records capable of sustaining the type of analysis necessary for the understanding of teacher labor market transitions. The importance of gathering this information as a means of assessing the possibility of shortages and surpluses cannot be overemphasized.

Second, data on teacher characteristics indicative of quality are virtually nonexistent. In order to assess whether districts are substituting teachers of lower quality for those of higher quality over time—an important indicator of a shortage—researchers must have a means of distinguishing different quality levels of teachers. This is a problem that is endemic to all educational research due to the difficulty of determining adequate quality measures. Despite this difficulty, however, many states do not collect even simple quality measures, such as scores on standardized tests taken by all teachers. In particular, changes in the performance of students after exposure to particular teachers are rarely tracked, yet this information would provide extremely valuable data on teacher quality.

In revealing the building blocks of supply and demand, our study highlights the absence of data on key indicators and identifies the type of longitudinal data needed to assess shortage or surplus conditions. In addition, it points to the need for further work in the development of multivariate behavioral models capable of explaining all the relevant trends. At the current state of the art, teacher attrition has been modeled in some detail, but models of entry into the teaching profession, student course-taking decisions, district course-offering decisions, district hiring decisions, and local and state funding allocations are in their infancy. None of these types of behavioral models has been applied to the vocational education subfield of teaching. Answering questions regarding supply and demand and developing appropriate behavioral models will require both new quantitative and qualitative research, improved data collection efforts, the further application of theoretical rigor to teacher labor market phenomena, and the further subjection of theory to empirical testing at the local and state market levels.

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APPENDIX 1

Description of Primary Data Sources

Schools and Staffing Survey and Teacher Follow-Up Survey

National data on high school vocational and nonvocational education teachers were taken from the Schools and Staffing Surveys (SASS) and Teacher Follow-Up Surveys (TFS). The SASS, conducted by the National Center for Education Statistics (NCES), is billed as "the largest and most thorough national integrated survey of districts, schools, administrators, and teachers ever undertaken in the United States." The survey has been administered in three waves: 1987-1988, 1990-1991, and 1993-1994. While each years' SASS covers districts, schools, and teachers, the surveys themselves are sent to individual schools, with teachers and principals sampled from the selected schools and districts. Schools and districts are selected in such a way as to create a complete profile of teachers and schools by community type, school type, and school level. In each wave, around 56,000 public school teachers were part of the sample, all of whom were teaching in the schools sampled—9,956 schools in the 1993-1994 survey. Weights were included in the data files to assist in estimation of national estimates. These weights were the inverse of the probability of selection, adjusted for nonresponse rates and sample totals. All estimates in this analysis were based on these weights. Because the data are from a sample of teachers, they are subject to sampling error, along with other errors including processing and coding errors, and respondent memory and interpretation errors.

National data from the SASS were used mainly to construct a picture of the nation's vocational education teachers, breaking down where possible differences among the various vocational education subfields. Most of the descriptive survey questions used to construct this analysis remained constant over the three surveys. One important survey question which differed in 1987-1988 was the classification of teaching field: several vocational education subfields were not present on the survey that year. Thus, estimates of other subfields for that year are suspect, since many teachers would have had to classify themselves differently than in later years.

In conjunction with the SASS, NCES has conducted three TFSs in an attempt to uncover changes in the teaching population that might occur over one year—changes such as attrition or moving, field switching or returning to college for additional degrees. The TFS was conducted in 1989, 1992, and 1995, and in each case a sample of SASS-respondent teachers was resurveyed using the TFS questionnaire. While the TFS can be used to examine national patterns of attrition and hence teacher supply and

demand, for the purposes of this study its utility was limited by the small number of teachers surveyed in each vocational education subfield.

New York

The dataset was compiled using New York State Personnel Master File data for the school years ending 1980 through 1998. A year of Personnel Master File data contains one record per individual for each assignment. For example, if an individual teaches six classes, there are six records.

Ostensibly, an anomaly was discovered in the Personnel Master File data. Namely, there are many records for which there is only one year of reported data for an individual who reports something other than one year of district experience. A plausible explanation for this anomaly is that these records contain a miscoded social security number and thus "belong" to another record which is missing data for the particular year in question. It is also plausible, however, that these records contain a miscoded district experience variable and indeed represents a "quit" after one year of work. Given the extent to which the choice of the more plausible explanation would influence the results of our analysis, considerable care was taken in reaching such a decision.

The following is a list of the criteria used to eliminate anomalous records:

- Records for which district experience is greater than two *and* occupation type is reported as either teacher, administrator, or other education *and* occupation location is reported as teaching in district last year (Note: The *and* used above references the logical *and*.)
- Records for all individuals that report less than 95% as percentage of time employed—that is, keep only full-time employees
- Records for which appointment is reported as tenured

All other records (i.e., those not matching any of the above criteria) were considered quits after one year of work. On average, the above criteria eliminated approximately 75% of the anomalous records.

The above criteria resulted in the elimination of 24,619 of the 448,653 records for the period covering the years ending 1980 through 1998.

In addition, all records in which the individual worked in a district that had merged, over the 1980 through 1998 period, were deleted. This resulted in the elimination of 8,692 records.

Thus, the number of records used in the analysis was 415,342. Moreover, these remaining records were "cleaned" in the following ways:

Records believed to be missing data, due to the miscoding of a social security number as described above, were "filled." More precisely, if the school code variable for any particular year was missing data, the "occupation type last year" variable for the subsequent year was examined. If the individual reported having worked as an administrator, teacher, or

other education (for the previous year), the school code variable was filled with a 1. In addition, the total experience variable was made to be sequential so long as the individual was considered working during any particular year.

Texas

Because of the limitations of the NCES surveys, longitudinal data from two states, New York and Texas, were used to present a more complete picture of teacher supply and demand. Data from Texas teachers were available for the years 1979 to 1997; however, due to difficulty identifying teacher field in the earlier years of this data, this analysis was restricted to the years 1988 to 1997. Like New York, Texas is an attractive subject because of the diversity of its school districts. Texas districts range from the very large (Houston's has over 200,000 students) to extremely small (the Divide school district has just 16 students, and many rural districts have fewer than 50). Texas districts also vary considerably in other areas, including proportion of students in poverty and ethnic composition of the student body or teaching staffs. All of the major vocational education subfields are present in Texas, and data on subfield taught are available for 1988 to 1997. Finally, as universal data, the Texas dataset provides a large number of observations on almost every facet of the state's education: the data cover 1,044 districts, 6,600 schools, 240,000 educators, and 3.7 million public school students of which just under one million were high school students in 1996.

Data on Texas teachers were mainly used to confirm conclusions obtained from national data, present a state-level survival analysis of teacher attrition patterns, and examine quit patterns within individual vocational education subfields. Variables employed included overall numbers of teachers, district characteristics, school characteristics, teacher salary, field, subfield, experience, and other teacher characteristics. During the period of study, there were 10,000 to 12,000 vocational education teachers in Texas.

APPENDIX 2

Supplementary Information from the National New York and Texas Teacher Databases

Appendix 4.2.2. Proportion of Teachers Who Are Female, Vocational Education Teachers in Comprehensive High Schools Versus Teachers in Vocational Schools, Nationwide, by Year

Year	*Comprehensive*	*Vocational*	*Difference*
1988	0.49	0.32	0.18
1991	0.50	0.32	0.19
1994	0.49	0.32	0.17

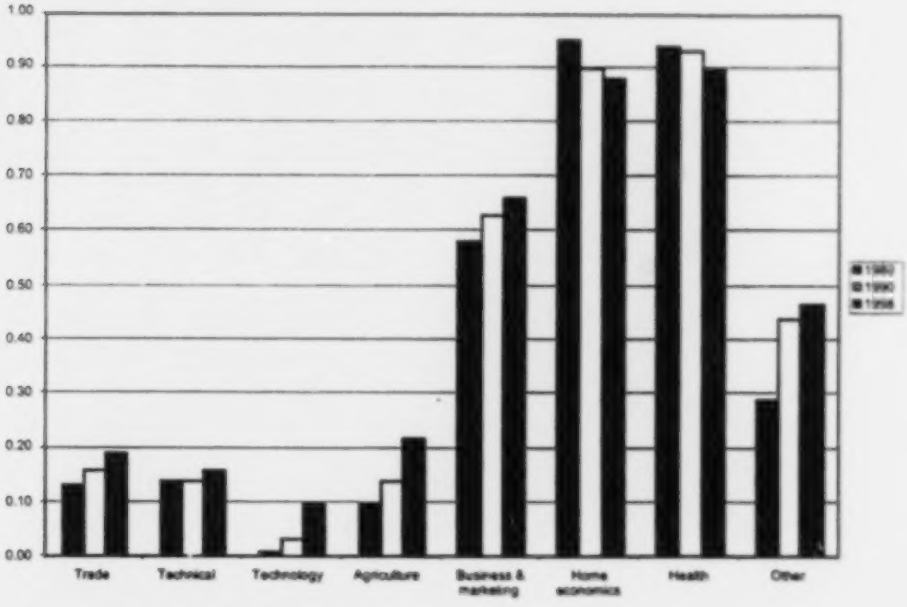
Source: Schools and Staffing Survey

Appendix 4.2.3. Proportion of Teachers Who Are Female in Each Vocational Education Subfield, Nationwide, by Year

Year	*Agriculture*	*Business*	*Health*	*Home Economics*	*Industrial Arts*	*Trade and Industry*	*Technical*	*Other Vocational*
1988		0.71		0.98	0.02			0.24
1991	0.07	0.67	0.87	0.99	0.04	0.09	0.11	0.50
1994	0.12	0.71	0.84	0.99	0.03	0.05	0.04	0.43

Source: Schools and Staffing Survey
Note: Some vocational education subfields were not specified in the 1987-1988 SASS. Blank entries represent subfields not surveyed.

Figure 4.2.3. Proportion of Teachers Who Are Female in Each Vocational Education Subfield, in New York, by Year



Source: Schools and Staffing Survey

Appendix 4.2.4. Proportion of Teachers Who Are Female, Vocational Versus Nonvocational Education Teachers, in Texas, by Year

Year	*Vocational*	*Nonvocational*	*Difference*
1988	0.52	0.80	-0.28
1989	0.51	0.80	-0.29
1990	0.51	0.80	-0.28
1991	0.52	0.80	-0.27
1992	0.54	0.80	-0.26
1993	0.54	0.80	-0.26
1994	0.55	0.80	-0.25
1995	0.53	0.79	-0.26
1996	0.53	0.79	-0.25

Source: Texas Education Agency

Appendix 4.2.5. Proportion of Teachers Who Are Female in Each Vocational Education Subfield, in Texas, by Year

Year	Agriculture	Business	Health	Home Economics	Industrial Arts	Trade and Industry	Other Vocational
1988	0.04	0.75	0.97	1.00	0.05	0.15	0.75
1989	0.04	0.74	0.96	0.99	0.04	0.15	0.75
1990	0.04	0.75	0.95	0.99	0.04	0.15	0.77
1991	0.05	0.73	0.94	0.98	0.05	0.16	0.78
1992	0.05	0.73	0.95	0.98	0.05	0.15	0.78
1993	0.05	0.73	0.95	0.98	0.05	0.16	0.78
1994	0.05	0.74	0.96	0.98	0.05	0.16	0.79
1995	0.06	0.75	0.92	0.98	0.06	0.16	0.80
1996	0.08	0.78	0.91	0.97	0.07	0.17	0.78

Source: Texas Education Agency
Note: Some vocational education subfields were not specified in the 1987-1988 SASS. Blank entries represent subfields not surveyed.

Appendix 4.2.6. Proportion of Teachers Who Are Female, Vocational Versus Nonvocational Education Teachers, in New York, by Year

Year	Vocational	Nonvocational	Difference
1980	0.41	0.62	-0.21
1985	0.43	0.65	-0.22
1990	0.45	0.69	-0.24
1995	0.45	0.72	-0.27
1998	0.46	0.73	-0.27

Source: New York Personnel Master File

Appendix 4.2.7. Proportion of Teachers Who Are Female in Each Vocational Education Subfield, in New York, by Year

Year	Trade	Technical	Technology	Agriculture	Business and Marketing	Home Economics	Health	Other
1980	0.13	0.14	0.01	0.10	0.58	0.95	0.94	0.29
1985	0.14	0.08	0.02	0.13	0.61	0.94	0.94	0.43
1990	0.16	0.14	0.03	0.14	0.63	0.90	0.93	0.44
1995	0.17	0.18	0.07	0.19	0.64	0.88	0.91	0.45
1998	0.19	0.16	0.10	0.22	0.66	0.88	0.90	0.47

Source: New York Personnel Master File
Note: Some vocational education subfields were not specified in the 1987-1988 SASS. Blank entries represent subfields not surveyed.

Appendix 4.3.1. Proportion of Teachers Who Are Nonwhite, Vocational Versus Nonvocational Education Teachers, Nationwide, by Year

Year	*Vocational*	*Nonvocational*	*Difference*
1988	0.12	0.12	0.01
1991	0.13	0.12	0.01
1994	0.12	0.13	0.00

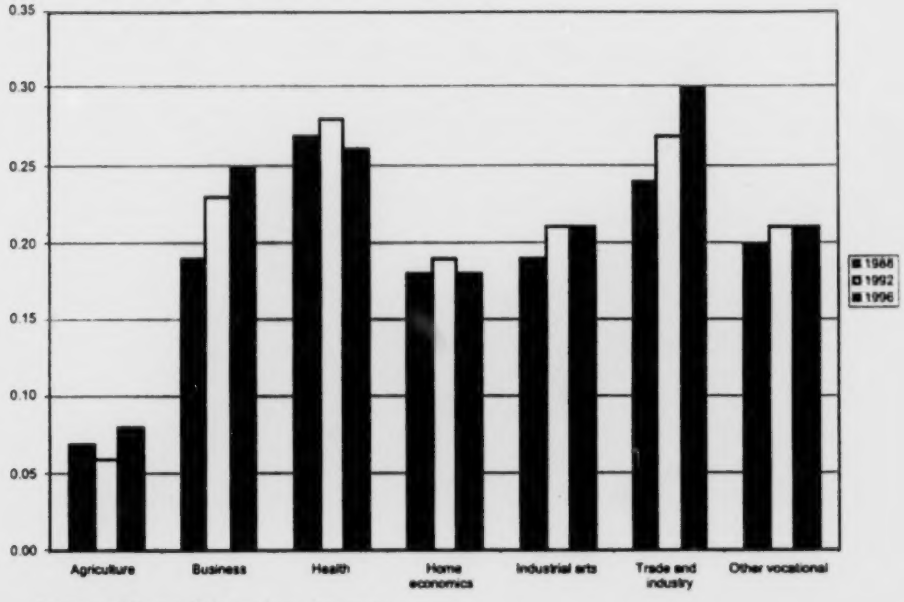
Source: Schools and Staffing Survey

Appendix 4.3.2. Proportion of Teachers Who Are Nonwhite, Vocational Education Teachers in Comprehensive High Schools Versus Teachers in Vocational Schools, Nationwide, by Year

Year	*Comprehensive*	*Vocational*	*Difference*
1988	0.12	0.13	-0.01
1991	0.13	0.10	0.03
1994	0.13	0.10	0.03

Source: Schools and Staffing Survey

Figure 4.3.2. Proportion of Teachers Who Are Nonwhite in Each Vocational Education Subfield, in Texas, by Year



Source: Texas Education Agency

Appendix 4.3.3. Proportion of Teachers Who Are Nonwhite in Each Vocational Education Subfield, Nationwide, by Year

Year	Agriculture	Business	Health	Home Economics	Industrial Arts	Trade and Industry	Technical	Other Vocational
1988		0.14		0.15	0.10			0.11
1991	0.09	0.13	0.12	0.15	0.11	0.10	0.09	0.16
1994	0.09	0.14	0.13	0.13	0.09	0.10	0.09	0.18

Source: Schools and Staffing Survey
Note: Some vocational education subfields were not specified in the 1987-1988 SASS. Blank entries represent subfields not surveyed.

Appendix 4.3.4. Proportion of Teachers Who Are Nonwhite, Vocational Versus Nonvocational Education Teachers, in Texas, by Year

Year	Vocational	Nonvocational
1988	0.20	0.23
1989	0.20	0.22
1990	0.20	0.22
1991	0.21	0.22
1992	0.21	0.23
1993	0.22	0.23
1994	0.23	0.23
1995	0.21	0.23
1996	0.21	0.24

Source: Texas Education Agency

Appendix 4.3.5. Proportion of Teachers Who Are Nonwhite in Each Vocational Education Subfield, in Texas, by Year

Year	Agriculture	Business	Health	Home Economics	Industrial Arts	Trade and Industry	Other Vocational
1988	0.07	0.19	0.27	0.18	0.19	0.24	0.20
1989	0.06	0.21	0.26	0.19	0.19	0.23	0.21
1990	0.06	0.23	0.29	0.18	0.20	0.24	0.20
1991	0.07	0.22	0.29	0.18	0.19	0.25	0.21
1992	0.06	0.23	0.28	0.19	0.21	0.27	0.21
1993	0.06	0.24	0.25	0.18	0.21	0.27	0.21
1994	0.07	0.23	0.24	0.19	0.20	0.28	0.23
1995	0.07	0.29	0.25	0.19	0.19	0.29	0.22
1996	0.08	0.25	0.26	0.18	0.21	0.30	0.21

Source: Texas Education Agency
Note: Some vocational education subfields were not specified in the 1987-1988 SASS. Blank entries represent subfields not surveyed.

Appendix 4.4.5. Mean Age of Teachers, Vocational Versus Nonvocational Education Teachers, in Texas, by Year

Year	*Vocational*	*Nonvocational*	*Difference*	*p > |t|*
1988	42.71 (0.09)	40.19 (0.02)	2.52	0.000
1989	43.29 (0.09)	40.60 (0.02)	2.69	0.000
1990	43.67 (0.09)	40.76 (0.02)	2.91	0.000
1991	43.84 (0.09)	40.84 (0.02)	2.99	0.000
1992	44.06 (0.09)	40.93 (0.02)	3.13	0.000
1993	44.18 (0.09)	41.10 (0.02)	3.08	0.000
1994	44.50 (0.09)	41.25 (0.02)	3.24	0.000
1995	44.99 (0.09)	41.41 (0.02)	3.58	0.000
1996	45.08 (0.09)	41.60 (0.02)	3.48	0.000

Source: Texas Education Agency
Note: Standard errors are in parentheses.

Appendix 4.4.6. Mean Age of Teachers in Each Vocational Education Subfield, in Texas, by Year

Year	*Agriculture*	*Business*	*Health*	*Home Economics*	*Industrial Arts*	*Trade and Industry*	*Other Vocational*
1988	38.08	42.28	45.62	40.99	42.11	46.40	44.93
1989	38.80	42.61	46.38	42.28	42.68	46.72	44.99
1990	39.12	42.79	46.84	42.63	42.92	47.00	45.31
1991	39.23	42.65	46.69	42.91	43.27	47.34	45.36
1992	39.36	43.02	46.64	43.37	43.85	47.54	45.49
1993	39.51	43.46	46.12	43.75	44.36	47.74	45.51
1994	39.91	43.76	46.51	44.28	44.77	47.69	45.81
1995	39.77	43.43	46.09	44.67	45.29	47.66	45.66
1996	40.16	44.12	45.40	45.02	45.58	47.93	45.64

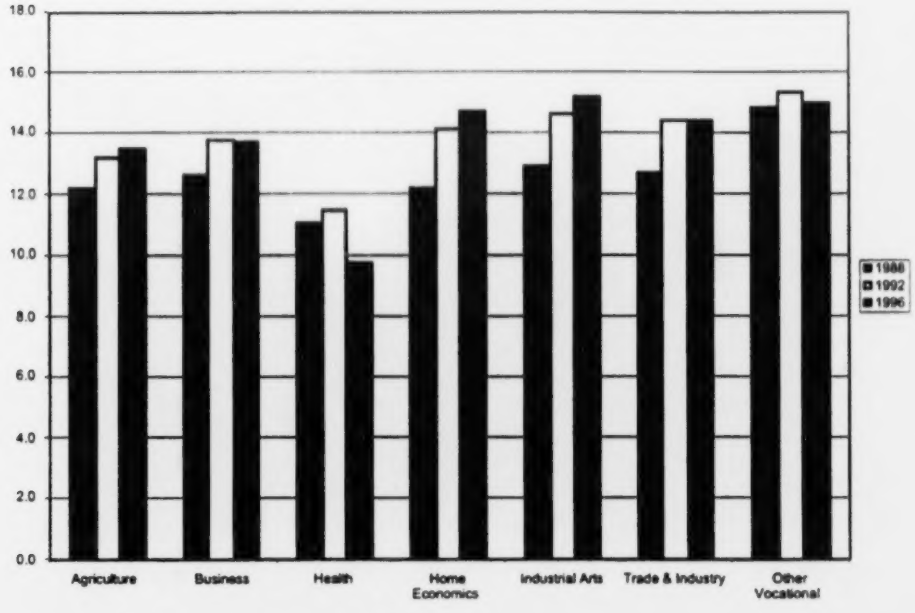
Source: Texas Education Agency

Appendix 4.4.7. Mean Age of Teachers, Vocational Versus Nonvocational Education Teachers, in New York, by Year

Year	*Vocational Education Teachers*	*Nonvocational Education Teachers*	*Difference*	*p > |t|*
1980	44.73 (10.20)	42.34 (9.42)	2.38	0.000
1985	44.73 10.20	42.34 (9.42)	2.38	0.000
1990	45.27 (9.61)	43.43 (9.48)	1.84	0.000
1995	46.06 (9.01)	44.31 (9.60)	1.75	0.000
1998	46.09 (9.15)	44.02 (10.11)	2.06	0.000

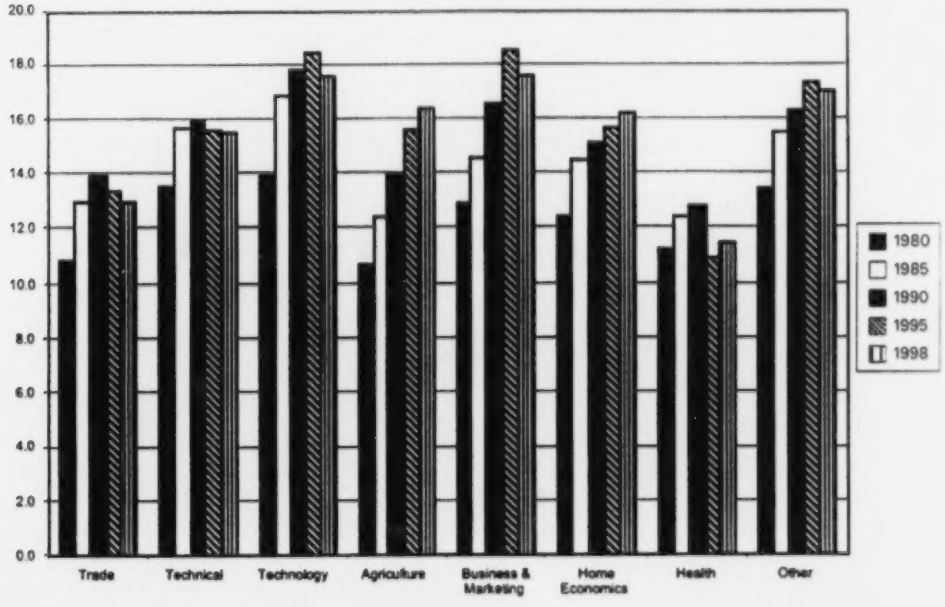
Source: New York Personnel Master File
Note: Standard deviations are in parentheses.

Figure 4.6.2. Mean Years of Teaching Experience of Teachers in Each Vocational Education Subfield, in Texas, by Year



Source: Texas Education Agency

Figure 4.6.3. Mean Years of Teaching Experience of Teachers in Each Vocational Education Subfield, in New York, by Year



Source: New York Personnel Master File

Appendix 4.6.4. Mean Years of Teaching Experience of Teachers, Vocational Versus Nonvocational Education Teachers, in Texas, by Year

Year	*Vocational*	*Nonvocational*	*Difference*	*P > |t|*
1988	12.7	10.7	2.0	0.000
1989	13.3	11.0	2.3	0.000
1990	13.7	11.1	2.6	0.000
1991	13.8	11.1	2.6	0.000
1992	14.0	11.2	2.8	0.000
1993	13.9	11.2	2.7	0.000
1994	14.0	11.3	2.7	0.000
1995	14.3	11.4	3.0	0.000
1996	14.3	11.5	2.8	0.000

Source: Texas Education Agency

Appendix 4.6.5. Mean Teaching Experience of Teachers in Each Vocational Education Subfield, in Texas, by Year

Year	*Agriculture*	*Business*	*Health*	*Home Economics*	*Industrial Arts*	*Trade and Industry*	*Other Vocational*
1988	12.2	12.6	11.1	12.2	12.9	12.7	14.8
1989	12.9	13.2	11.8	13.2	13.4	13.3	15.1
1990	13.1	13.1	11.8	13.3	13.9	13.7	15.3
1991	13.0	12.9	11.6	13.6	14.0	14.1	15.3
1992	13.2	13.8	11.5	14.1	14.6	14.4	15.3
1993	13.3	13.6	10.8	14.1	14.8	14.6	15.2
1994	13.4	13.8	10.4	14.5	14.9	14.4	15.4
1995	13.1	13.2	10.0	14.6	15.2	14.2	15.0
1996	13.5	13.7	9.8	14.7	15.2	14.4	15.0

Source: Texas Education Agency
Note: Some vocational education subfields were not specified in the 1987-1988 SASS. Blank entries represent subfields not surveyed.

Appendix 4.6.6. Mean Years of Teaching Experience of Teachers, Vocational Versus Nonvocational Education Teachers, in New York, by Year

Year	*Vocational*	*Nonvocational*	*Difference*	*p > |t|*
1980	12.7 (7.6)	12.5 (7.2)	0.2	0.000
1985	14.9 (7.8)	14.4 (7.8)	0.5	0.000
1990	16.1 (8.6)	14.9 (8.9)	1.2	0.000
1995	16.9 (9.2)	15.4 (9.5)	1.5	0.000
1998	16.5 (9.7)	14.9 (10.0)	1.6	0.000

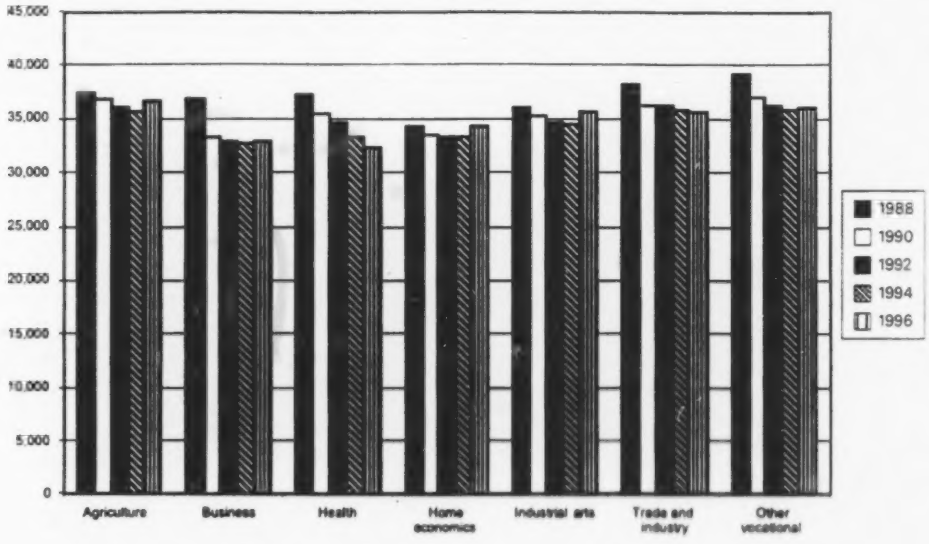
Source: New York Personnel Master File
Note: Standard deviations are in parentheses.

Appendix 4.6.7. Mean Years of Teaching Experience of Teachers in Each Vocational Education Subfield, in New York, by Year

Year	*Trade*	*Technical*	*Technology*	*Agriculture*	*Business and Marketing*	*Home Economics*	*Health*	*Other*
1980	10.8	13.6	13.9	10.7	12.9	12.4	11.2	13.5
1985	13.0	15.7	16.9	12.4	14.6	14.5	12.4	15.6
1990	14.0	16.0	17.9	14.1	16.6	15.1	12.8	16.4
1995	13.4	15.6	18.5	15.6	18.5	15.7	10.9	17.4
1998	13.0	15.5	17.6	16.4	17.6	16.2	11.5	17.1

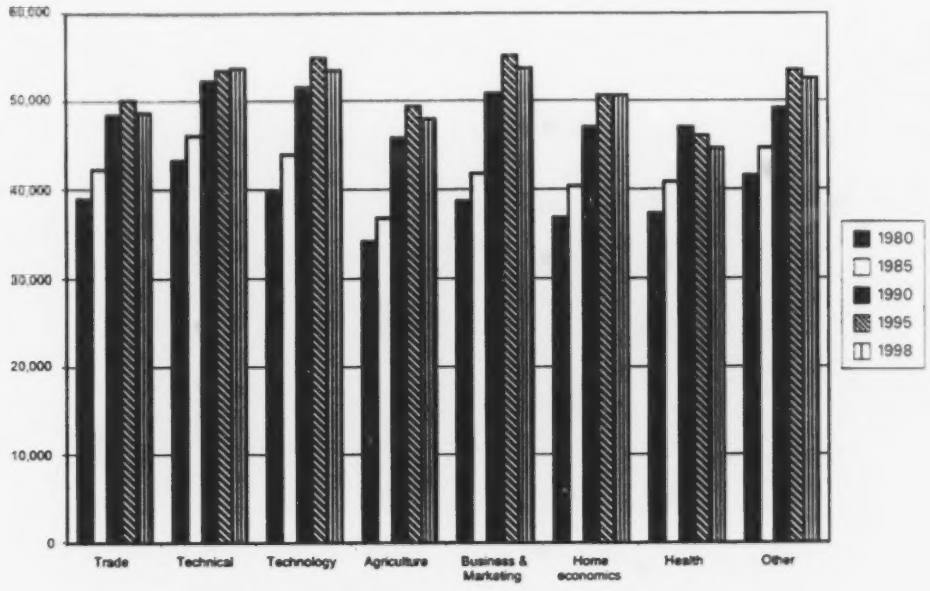
Source: New York Personnel Master File

Figure 4.8.2. Mean Real Salary of Teachers in Each Vocational Education Subfield, in Texas, by Year



Source: Texas Education Agency

Figure 4.8.3. Mean Real Salary of Teachers in Each Vocational Education Subfield, in New York, by Year



Source: New York Personnel Master File

Appendix 4.8.4. Mean Real Salary, Vocational Versus Nonvocational Education Teachers, in Texas, by Year

Year	*Vocational*	*Nonvocational*	*Difference*	*P > |t|*
1988	37,096 (28,904)	33,372 (20,609)	3,723	0.000
1989	35,969 (7,235)	32,469 (6,385)	3,500	0.000
1990	35,475 (7,068)	31,999 (6,115)	3,476	0.000
1991	35,183 (7,094)	31,778 (6,214)	3,405	0.000
1992	34,980 (6,909)	31,643 (6,214)	3,337	0.000
1993	35,074 (7,031)	31,756 (6,288)	3,318	0.000
1994	34,703 (7,409)	31,441 (6,412)	3,261	0.000
1995	34,431 (7,275)	31,242 (6,590)	3,189	0.000
1996	35,398 (8,119)	32,313 (7,336)	3,086	0.000

Source: Texas Education Agency
Note: Standard errors are in parentheses.

Appendix 4.8.5. Mean Real Salary of Teachers in Each Vocational Education Subfield, in Texas, by Year

Year	*Agriculture*	*Business*	*Health*	*Home Economics*	*Industrial Arts*	*Trade and Industry*	*Other Vocational*
1988	37,507	36,919	37,443	34,330	36,115	38,433	39,338
1989	37,265	34,166	36,816	34,084	35,575	36,863	37,904
1990	37,090	33,327	35,566	33,597	35,268	36,297	37,122
1991	36,507	33,060	34,939	33,480	34,728	36,235	36,694
1992	36,168	33,086	34,763	33,459	34,820	36,260	36,469
1993	35,953	33,104	34,628	33,568	34,993	36,455	36,468
1994	35,679	32,876	33,444	33,420	34,698	35,963	36,085
1995	35,125	32,516	32,277	33,234	34,550	35,463	35,006
1996	36,654	33,074	32,383	34,410	35,673	35,857	36,224

Source: Texas Education Agency
Note: Some vocational education subfields were not specified in the 1987-1988 SASS. Blank entries represent subfields not surveyed.

Appendix 4.8.6. Mean Real Salary, Vocational Versus Nonvocational Education Teachers, in New York, by Year

Year	*Vocational*	*Nonvocational*	*Difference*	*p > |t|*
1980	38843 (9406)	38370 (9567)	473	0.000
1985	42291 (10953)	41655 (11112)	636	0.000
1990	49559 (12876)	48526 (13006)	1033	0.000
1995	53105 (14555)	51202 (14604)	1903	0.000
1998	52085 (15818)	50551 (15635)	1534	0.000

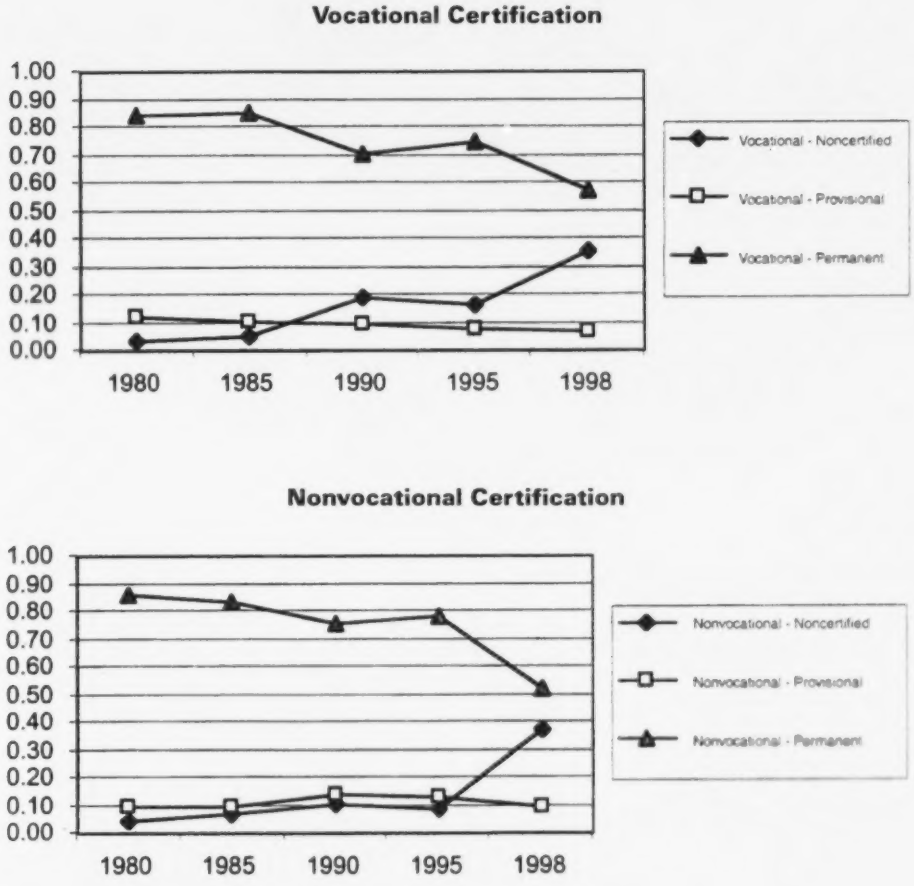
Source: New York Personnel Master File
Note: Standard errors are in parentheses.

Appendix 4.8.7. Mean Real Salary of Teachers in Each Vocational Education Subfield, in New York, by Year

Year	*Trade*	*Technical*	*Technology*	*Agriculture*	*Business and Marketing*	*Home Economics*	*Health*	*Other*
1980	39,124	43,274	39,942	34,271	38,807	36,906	37,481	41,575
1985	42,381	46,208	44,032	36,991	41,956	40,369	40,859	44,728
1990	48,544	52,396	51,456	45,742	50,809	46,908	47,010	49,252
1995	50,236	53,442	54,893	49,339	55,124	50,602	46,250	53,417
1998	48,664	53,742	53,491	47,992	53,744	50,642	44,621	52,497

Source: New York Personnel Master File
Note: Some vocational education subfields were not specified in the 1987-1988 SASS. Blank entries represent subfields not surveyed.

Appendix Figure 4.9.1. Proportion of Teachers Who Are Non-Certified, Provisionally Certified, and Permanently Certified, Vocational Versus Nonvocational Education Teachers, in New York, by Year



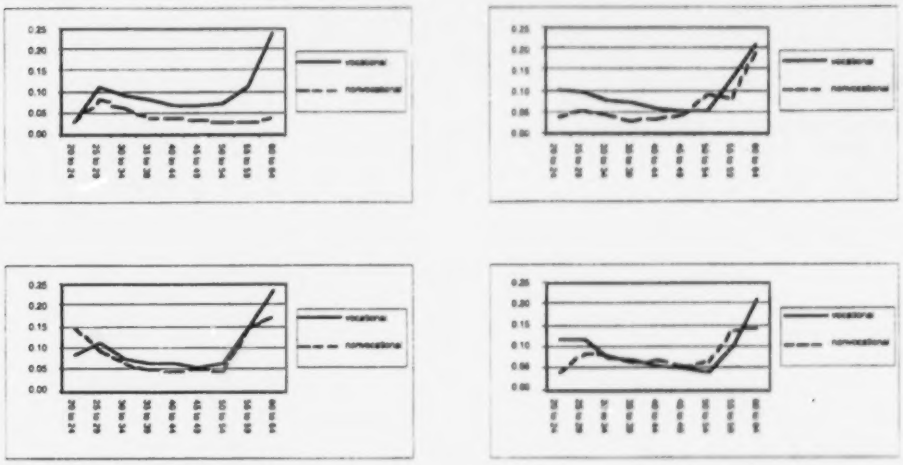
Source: New York Personnel Master File

Appendix 4.9.2. Proportion of Teachers Who Are Non-Certified, Provisionally Certified, and Permanently Certified, Vocational Versus Nonvocational Education Teachers, in New York, by Year

Year	*Non-Certified*	*Vocational Provisional*	*Permanent*	*Non-Certified*	*Nonvocational Provisional*	*Permanent*
1980	0.04	0.12	0.84	0.05	0.09	0.86
1985	0.05	0.10	0.85	0.07	0.10	0.83
1990	0.20	0.10	0.71	0.10	0.14	0.76
1995	0.17	0.08	0.75	0.09	0.13	0.78
1998	0.36	0.07	0.57	0.38	0.10	0.53

Source: New York Personnel Master File

Figure 4.15.3. Attrition of Teachers by Age Group, in Texas



Source: Texas Education Agency

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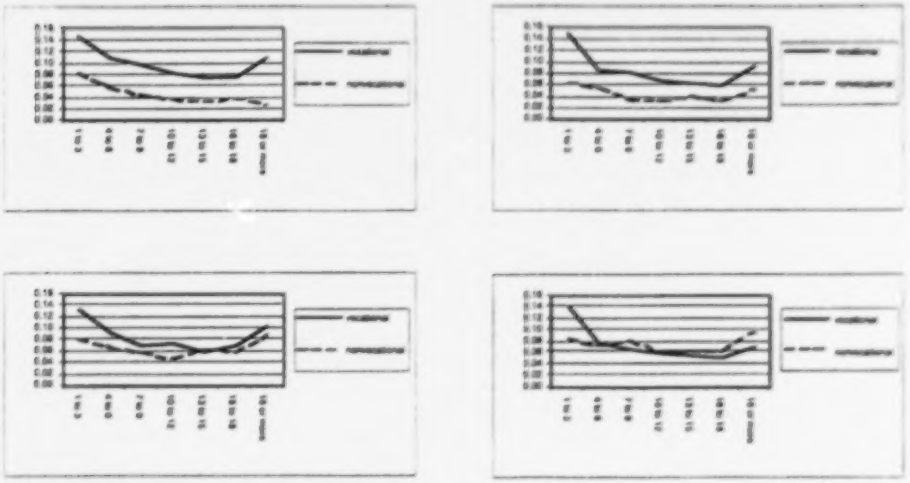
Figure 4.15.4. Attrition of Teachers by Experience Group, in Texas



Source: Texas Education Agency

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